FINAL DATA ANALYSIS REPORT FOR THE TRIBAL CONSUMPTION AND RESOURCE USE SURVEY FOR THE UPPER COLUMBIA RIVER SITE HUMAN HEALTH RISK ASSESSMENT AND REMEDIAL INVESTIGATION/FEASIBILITY STUDY

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EXECUTIVE SUMMARY

The Upper Columbia River site (UCR Site) is in the northeast portion of the State of Washington. The UCR Site "…consists of the areal extent of hazardous substances contamination within the United States (U.S.) in or adjacent to the UCR, including the Franklin D. Roosevelt Lake ("Lake Roosevelt"), from the border between the U.S. and Canada downstream to the Grand Coulee Dam, and all suitable areas in proximity to such contamination necessary for implementation of response actions…" (U.S. DOJ, 2006). The Site may include land and waters within the boundaries of the Colville Indian Reservation and the Spokane Indian Reservation, over which the Tribes have civil jurisdiction, as well as land and waters administered by the National Park Service (NPS) and the Bureau of Reclamation within the U.S. Department of the Interior (DOI). Teck Resources Limited ("Teck") is preparing a remedial investigation and feasibility study (RI/FS) in response to concerns regarding historical discharges of hazardous substances into the Columbia River, including but not limited to discharges of granulated slag, liquid effluents, emissions, and accidental spills and "upsets" from smelting processes and facility operations by Teck and its affiliated predecessors at the Trail facility located in Trail, British Columbia. On June 2, 2006, the U.S., on behalf of the U.S. Environmental Protection Agency (EPA) and U.S. Department of Justice (DOJ), and Teck American Incorporated (TAI) signed a Settlement Agreement requiring Teck to perform an RI/FS at the Site (cited herein as U.S. DOJ, 2006). In accordance with the Settlement Agreement, TAI will complete the RI/FS and baseline ecological risk assessment and EPA will complete the baseline human health risk assessment (HHRA).

The area surrounding the UCR (referred to in this report as the "Local Area;" see Figure 1) is used for a variety of recreational, subsistence, and cultural activities that can lead to exposure to potentially contaminated environmental media. Recreation within the Local Area includes camping, picnicking, boating, fishing, and swimming. In addition, two local Native American tribes (the Spokane Tribe of Indians [STI] and the Confederated Tribes of the Colville Reservation [CCT]) engage in activities (e.g., hunting, fishing, and gathering) and traditional tribal activities (e.g., construction of shelters or other structures or large objects; sweat lodge construction and use; weaving, coloring and dyeing, carving; food preparation and preservation; and medicinal, spiritual, or traditional practices) and/or live within the area. The STI developed exposure parameter values for traditional subsistence exposure scenarios (Harper et al., 2002; U.S. EPA, 2005a) to assess the potential risk from exposure to contaminants at the UCR Site. However, available information was not adequate to establish exposure parameter values for the CCT population.

The Tribal Consumption and Resource Use Survey (Tribal Survey) was conducted as part of the Upper Columbia River HHRA and RI/FS (U.S. DOJ, 2006) to identify pathways of exposure to environmental media in the Local Area that exist for the CCT and to provide exposure information for the HHRA. The Tribal Survey is intended to represent potential exposures of the CCT population residing on their Reservation resulting from current use of resources derived from the Local Area, such as food (e.g., fish, shellfish, waterfowl, game, and plants) and materials utilized in tribal practices (e.g., reeds for basket-weaving, water for sweat lodges, and plants for medicines).

The primary goal of the Tribal Survey was to obtain CCT-specific data that would allow reliable identification and characterization of potential exposures of the CCT population from utilization of environmental resources from the UCR Site. A secondary goal of the study was to identify and prioritize potential data collection needs for measuring concentrations of contaminants in foods and other

environmental resources harvested from the UCR Site that are utilized by the CCT population (either environmental resources from the UCR Site, or additional sampling locations within the UCR Site that were not previously identified or adequately characterized by the RI/FS sampling effort). Since the Tribal Survey was conducted, additional sampling of sediment, soil, fish, shellfish, and wild plants has been conducted in support of the RI/FS and HHRA for the Site.

In general, the Tribal Survey was designed to collect information on the frequency of use for specific exposure pathways that were identified in the HHRA Work Plan (U.S. EPA, 2009) as well as spatial information detailing where the resource was obtained. As described in Section 2, the Tribal Survey collected data on the use of resources located within the Local Area. The Tribal Survey also included a few questions to begin to assess the potential for avoidance of resources from the Local Area.

The Tribal Survey was completed and finalized in June, 2012 (Westat, 2012a). This report documents the methods and outcomes of analyses of data from the Tribal Survey. This report identifies pathway-specific exposure locations and estimates for contact rates with environmental media and use of natural resources (U.S. EPA, 2009). Analysis of the Tribal Survey results indicated that the information collected is adequate to characterize Site-specific exposure for most of the potential exposure pathways identified for residents of the Colville Reservation that involve utilization of environmental resources from the Local Area. The analysis also highlighted the following pathways as having the greatest potential for contact with potentially contaminated environmental media within the Local Area:

- Consumption of fish;
- Activities in surface water; and
- Activities on the beaches adjacent to the UCR.

The Tribal Survey data will be used to derive age-specific central tendency exposure (CTE) and reasonable maximum exposure (RME) values for pathways of exposure and location of contact with environmental media at (or derived from) the Local Area, including the Columbia River from the U.S./Canada border to the Grand Coulee Dam. All estimates are for people who consume the particular type of food or engage in the type of activity (‘consumers-only’). This report concludes with a discussion of exposure pathway completeness and compares the data available to derive exposure factors from the survey with values in the HHRA Work Plan (U.S. EPA, 2009). This includes an evaluation of uncertainties associated with the estimates derived from the survey data.

Based on analysis of the Tribal Survey data described in this report, data are sufficient to update the exposure pathway analysis for residents of the Colville Reservation and to produce reliable, Site-specific estimates of the exposure factors listed in Table ES-1. While data were gathered for multiple scenarios that include consumption of multiple types of biota and exposure to surface water, sediment/soil, and air during Tribal activities, some of these data will not be used in the HHRA. For example, ingestion of wild plants is likely to lead to greater exposures than dermal contact with plants during basket-weaving. As a result, this data analysis report presents and summarizes the data collected for some exposure scenarios that will not be quantitatively evaluated separately in the baseline Site-wide HHRA.

Table ES-1 lists the exposure parameters for residents of the Colville Reservation that may be utilized in the HHRA for the UCR Site and the data from the Tribal Survey that may be used to derive those parameters.

Table ES-1. Tribal Survey Data that may be used in the UCR Site-wide HHRA to Derive Exposure Parameters for the Resident of the Colville Reservation Population

Exposure Scenario	Exposure Parameter	Units	Exposure Parameter Notes	Relevant Section of this Document	Conclusion
Fish consumption	Daily Consumption Rate (DCR)	grams/day	Adults and children: National Cancer Institute (NCI) model estimates for fish DCR.	5.2.2; Table 8	Data from the Tribal Survey were adequate to derive the exposure parameter for adults and children.
Mussel consumption	DCR	grams/day	Adults: Estimated consumption frequency of mussels with Food Questionnaire (FQ) data. Automated Multiple Pass Method (AMPM) meal size data for market shellfish may be supplemented with data from the literature or CCT. Children: May be estimated using DCR for adults and the ratio of child to adult total energy expenditure estimated with Institute of Medicine (IOM) regression model.	5.2.3; Table 9	Data from the Tribal Survey were adequate to derive consumption frequency for adults. Meal size data from the AMPM may be supplemented with data from the literature or CCT. Child DCR may be estimated as described in Section 4.3.
Crayfish consumption	DCR	grams/day	Adults: Estimated consumption frequency of crayfish with FQ data. AMPM meal size data for market shellfish may be supplemented with data from the literature or CCT. Children: May be estimated using DCR for adults and the ratio of child to adult total energy expenditure estimated with IOM regression model.	5.2.3; Table 9	Data from the Tribal Survey were adequate to derive consumption frequency for adults. Meal size data from the AMPM may be supplemented with data from the literature or CCT. Child DCR may be estimated as described in Section 4.3.
Amphibian and reptile consumption	DCR	grams/day	Adults: Estimated consumption frequency of 'other aquatic' organisms with FQ data. AMPM meal size data for market shellfish may be supplemented with data from the literature or CCT. Children: May be estimated using DCR for adults and the ratio of child to adult total energy expenditure estimated with IOM regression model.	5.2.3; Table 9	Data from the Tribal Survey were adequate to derive consumption frequency for adults. Meal size data from the AMPM may be supplemented with data from the literature or CCT. Child DCR may be estimated as described in Section 4.3.
Wild game (mammal) consumption	DCR	grams/day	Adults: NCI model estimate for DCR for venison. Children: Estimated using DCR for adults and the ratio of child to adult average venison meal sizes.	5.2.4.1; Table 11	Data from the Tribal Survey were adequate to derive the exposure parameter for adults and children.

Table ES-1. Tribal Survey Data that may be used in the UCR Site-wide HHRA to Derive Exposure Parameters for the Resident of the Colville Reservation Population

Exposure Scenario	Exposure Parameter	Units	Exposure Parameter Notes	Relevant Section of this Document	Conclusion
Wild upland bird consumption	DCR	grams/day	Adults: Estimated consumption frequency of wild upland birds with FQ data and meal size estimated using AMPM data for chicken. Children: May be estimated using the DCR for adults and ratio of child to adult total energy expenditure estimated with IOM regression model.	5.2.4.2; Tables 12 and 13	Data from the Tribal Survey were adequate to derive the exposure parameter for adults. Child DCR may be estimated as described in Section 4.3.
Wild waterfowl consumption	DCR	grams/day	Adults: Estimated with FQ data for consumption frequency of wild waterfowl and meal size estimated using AMPM data for chicken. Children: May be estimated using the DCR for adults and the ratio of child to adult total energy expenditure estimated with IOM regression model.	5.2.4.3; Tables 12 and 13	Data from the Tribal Survey were adequate to derive the exposure parameter for adults. Child DCR may be estimated as described in Section 4.3.
Cultural/wild terrestrial plant consumption	DCR	grams/day	Adults: Estimated species-specific consumption frequency of plants with FQ data and meal size estimate for huckleberries. Meal size for other species will be provided by the CCT. Children: May be estimated using the DCR for adults and the ratio of child to adult total energy expenditure estimated with IOM regression model, unless CCT provides meal sizes for children.	5.2.8; Tables 18 and 19; Appendix G	Data from the Tribal Survey were adequate to derive consumption frequency of wild plants, and meal size for huckleberries for adults. Meal size for other species for adults to be provided by the CCT. Child DCR may be estimated as described in Section 4.3, unless CCT provides meal sizes for children.
Incidental ingestion and dermal contact with soil	EF	days/year	Estimated frequency spent engaging in activities on land	5.3.1.3; Table 28	Data from the Tribal Survey were adequate to derive the exposure parameter for adults and children.
Incidental ingestion and dermal contact with surface water	ET	hours/day	Estimated time spent engaging in activities in water	5.3.1.1; Table 23	Data from the Tribal Survey were adequate to derive the exposure parameter for adults and children.
	EF	days/year	Estimated frequency spent engaging in activities in water	5.3.1.1; Table 22	Data from the Tribal Survey were adequate to derive the exposure parameter for adults and children.
Incidental ingestion and dermal contact with sediment	EF	days/year	Estimated frequency spent engaging in activities on land	5.3.1.3; Table 28	Data from the Tribal Survey were adequate to derive the exposure parameter for adults and children.

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ACRONYMS AND ABBREVIATIONS

AIC	Akaike Information Criterion
AMPM	Automated Multiple Pass Method
CAPI	Computer-Assisted Personal Interviewing
CCT	Confederated Tribes of the Colville Reservation
COI	Chemical of Interest
CSM	Conceptual Site Model
CTE	Central Tendency Exposure
CV	Coefficient of Variation
DCR	Daily Consumption Rate
DOI	U.S. Department of the Interior
DOJ	U.S. Department of Justice
DQO	Data Quality Objective
E911	Enhanced 911
ECF	Exposure Core Foods
EF	Exposure Frequency
EI	Environment International LTD
EPC	Exposure Point Concentration
ET	Exposure Time
FCID	Food Commodity Intake Database
FDA	U.S. Food and Drug Administration
FFQ	Food Frequency Questionnaire
FNDDS	Food and Nutrient Database for Dietary Studies
FQ	Food Questionnaire
HHRA	Human Health Risk Assessment
HIF	Human Intake Factor
IEc	Industrial Economics, Incorporated
IRB	Institutional Review Board
LCL	Lower Confidence Limit
LRNRA	Lake Roosevelt National Recreation Area
LTL	Lower Tolerance Limit
MOP	Manual of Operating Procedures
MWL	The Mountain-Whisper-Light Statistics
NCI	National Cancer Institute
NHANES	National Health and Nutrition Examination Survey
NPS	National Park Service
P50	50^{th} Percentile
P90	90^{th} Percentile
P95	95^{th} Percentile
PDP	Pesticide Data Program
RecUse Survey	Recreational Consumption and Resource Use Survey
ReUP	Resource Utilization and Practices Questionnaire
RI/FS	Remedial Investigation and Feasibility Study

RM	River Mile
RME	Reasonable Maximum Exposure
SD	Standard Deviation
SE	Standard Error
STI	Spokane Tribe of Indians
TAI	Teck American Incorporated
TDS	Total Diet Study
Teck	Teck Resources Limited
Tribal Survey	Tribal Consumption and Resource Use Survey
UCL	Upper Confidence Limit
UCR	Upper Columbia River
U.S.	United States
USDA	U.S. Department of Agriculture
U.S. EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UTL	Upper Tolerance Limit
WWEIA	What We Eat in America

1.0 INTRODUCTION

1.1 Site Background

The Upper Columbia River site (UCR Site) is in the northeast portion of the State of Washington. The UCR Site "…consists of the areal extent of hazardous substances contamination within the United States (U.S.) in or adjacent to the UCR, including the Franklin D. Roosevelt Lake ("Lake Roosevelt"), from the border between the U.S. and Canada downstream to the Grand Coulee Dam, and all suitable areas in proximity to such contamination necessary for implementation of response actions…" (U.S. DOJ, 2006). The Site may include land and waters within the boundaries of the Colville Indian Reservation and the Spokane Indian Reservation, over which the Tribes have civil jurisdiction, as well as land and waters administered by the National Park Service (NPS) and the Bureau of Reclamation within the U.S. Department of the Interior (DOI). Teck Resources Limited ("Teck") is preparing a remedial investigation and feasibility study (RI/FS) in response to concerns regarding historical discharges of hazardous substances into the Columbia River, including but not limited to discharges of granulated slag, liquid effluents, emissions, and accidental spills and "upsets" from smelting processes and facility operations by Teck and its affiliated predecessors at the Trail facility located in Trail, British Columbia. On June 2, 2006, the U.S., on behalf of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Justice (DOJ), and Teck American Incorporated (TAI) signed a Settlement Agreement requiring Teck to perform an RI/FS at the Site (cited herein as U.S. DOJ, 2006). In accordance with the Settlement Agreement, TAI will complete the RI/FS and baseline ecological risk assessment and EPA will complete the baseline human health risk assessment (HHRA).

As described in the *Human Health Risk Assessment Work Plan for the Upper Columbia River Site Remedial Investigation and Feasibility Study* (UCR HHRA Work Plan; U.S. EPA, 2009), the UCR Site is used for recreational activities (boating, camping, canoeing, hunting, fishing, picnicking, swimming and wading); subsistence hunting, fishing, and gathering; and for cultural pursuits important to local Native American tribes, including the Spokane Tribe of Indians (STI) and the Confederated Tribes of the Colville Reservation (CCT). Potentially exposed populations include recreational visitors, workers, subsistence populations, and residents (U.S. EPA, 2009). The STI developed exposure parameter values for *traditional subsistence* exposure scenarios (Harper et al., 2002; U.S. EPA, 2005a). However, previously available information was not adequate to establish Site-specific exposure parameter values for the CCT population for use in the HHRA.

In addition to evaluating exposure to the STI, the HHRA will include an assessment of risks specific to the CCT population (residents of the Colville Reservation). This scenario represents exposures of the CCT population resulting from current tribal cultural practices that involve utilization of environmental resources from the Local Area[1] (Figure 1). Therefore, a survey of the CCT population (referred to in this report as the *Tribal Survey*) was conducted to collect information about their use of the Local Area as a food source (e.g., fish, shellfish, waterfowl, game, plants, etc.) and as a source of materials utilized in tribal practices (e.g., reeds for basket-weaving, water for sweat lodges, plants for medicines, etc.).

[1] The *Local Area* includes the UCR and the land located within the geographic extent of the CCT Resource Zones (see Figure 1). The geographic extent of the UCR Site has not been determined yet (see first sentence of Section 1.1).

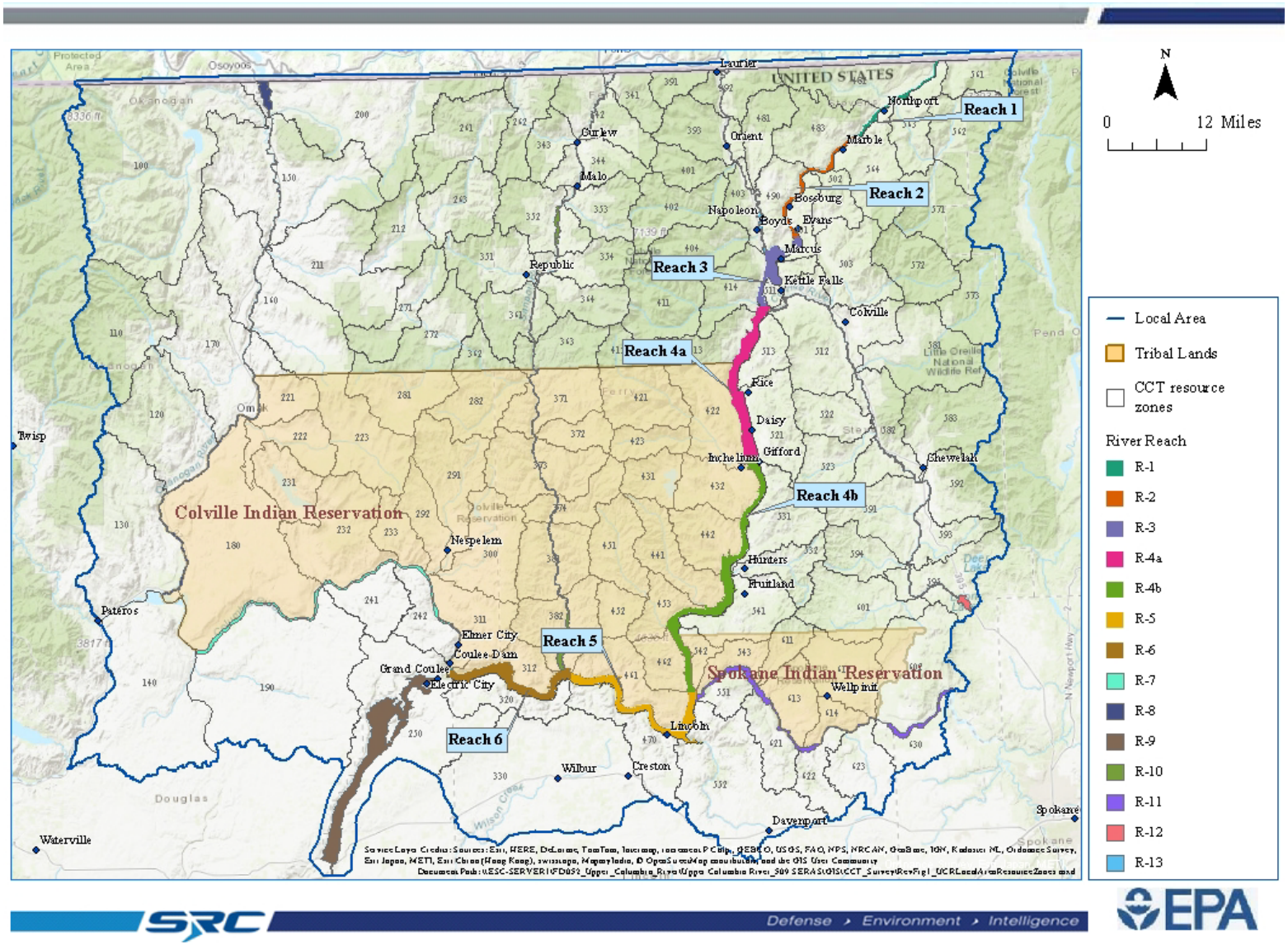


Figure 1. The extent of the Local Area, UCR Reaches R1–R6 and other rivers located within the Local Area.

The Tribal Survey is one of two population surveys that were conducted in the Local Area (U.S. EPA, 2010; Westat, 2012a). The Recreational Consumption and Resource Use Survey (RecUse Survey; Industrial Economics, Incorporated [IEc], 2012) collected information about picnicking, camping, boating, swimming, and fish consumption from visitors to the Lake Roosevelt National Recreation Area (LRNRA) and the UCR. Data obtained from the RecUse Survey are described in the *Draft Final Data Analysis Report for the Recreational Use Survey for the UCR Site HHRA and RI/FS* (SRC, 2019).

1.2 Scope and Organization of this Report

Westat (2012a) presents the Tribal Survey methodology, describes the survey instruments and collection of data, and summarizes those data. This report documents methods and results of further analyses of data from the Tribal Survey that were used to estimate values for contact rates with environmental media and use of natural resources, some of which will be used to derive exposure parameters for the Resident of the Colville Reservation population in the HHRA. A large amount of data was collected in the Tribal Survey that may ultimately serve a variety of uses, in addition to calculating representative central tendency exposure (CTE) and reasonable maximum exposure (RME) estimates for exposure parameters identified by the U.S. EPA (2009) for use in the HHRA. For example, data collected on dietary habits could potentially be used to support nutritional epidemiology. Data on locations of resource gathering could potentially be used to prioritize resource preservation efforts or to develop sampling plans for measuring levels of chemicals of interest (COIs) in these resources. The scope of this report is restricted to describing how data from the Tribal Survey may be used to estimate exposure parameters for the Residents of the Colville Reservation population in the HHRA. In addition to the introduction, this report is organized into the following sections:

Section 2	This section provides a description of the objectives of the Tribal Survey.
Section 3	This section provides a brief overview of the design of the Tribal Survey, including a description of the survey instruments and data collection methodology.
Section 4	This section provides the methods used to analyze and reduce/reformat/recode the data for applications in the HHRA. This includes detailed information on conversion factors and statistical software and methods used, as well as a description of the target population and spatial analysis procedure for each survey instrument.
Section 5	This section provides the results of the Tribal Survey data analysis. It includes: (1) an overview of dietary and non-dietary data from each survey instrument to estimate chemical exposure for use in the HHRA; (2) responses to questions on what foods were consumed, how much and how frequently they were consumed, and if obtained locally, where they were obtained; (3) a description of non-dietary use of local materials and natural resources for subsistence and tribal practices; and (4) a discussion of uncertainty associated with the survey data analysis.
Section 6	This section provides an analysis of data gathered from the Tribal Survey on resource avoidance.

Section 7 This section provides a comparison of the results of the survey data analysis to the Conceptual Site Model (CSM)[2] and estimated exposure parameters presented in the HHRA Work Plan for the UCR Site (U.S. EPA, 2009) to evaluate whether specific exposure pathways for the Colville Reservation resident population are complete.

1.3 Project Management

As described in the *Tribal Consumption and Resource Survey Work Plan for the Upper Columbia River Site Human Health Risk Assessment and Remedial Investigation/Feasibility Study* (Tribal Survey Work Plan; U.S. EPA, 2010), all work on the Tribal Survey was overseen by U.S. EPA and the CCT. Survey interviews were conducted by interviewers hired and supervised by the CCT. The CCT Project Leader served as the point of contact for access to CCT members, lands, and other tribal resources to ensure success of the survey. The CCT and their contractor, Environment International LTD (EI), also assembled a Survey Design and Oversight Panel composed of Elders, Resource Managers, and other subject experts to gather and review information as needed for the design and implementation of the survey. The CCT interview team was responsible for the recruitment of survey subjects.

Under contract to U.S. EPA, Westat was responsible for designing the data collection instruments using local resource information provided by the CCT and EI, as well as developing the study design and sampling strategies. Westat also conducted pilot testing of survey instruments and provided on-site training for CCT interviewers, in conjunction with CCT and EI staff. In consultation with the CCT, Westat prepared a Manual of Operating Procedures (MOP) for the field staff, which contained quality control procedures and other procedures necessary for successful implementation and completion of the survey (Westat, 2009a, 2009b, 2009c).

Under contract to U.S. EPA, SRC's contribution to U.S. EPA (2010) focused on development of the Data Quality Objectives (DQOs), the data analysis plan for HHRA applications of Tribal Survey data (see Section 10 and Attachment E), and analysis of Tribal Survey data to support the HHRA.

The survey was approved by the Institutional Review Boards (IRBs) at Westat and U.S. EPA. A Research Permit was also granted by the Colville Business Council and a Certificate of Confidentiality was obtained from the National Institutes of Health to provide additional protection to survey participants.

2.0 SURVEY GOALS AND OBJECTIVES

2.1 Overview

The HHRA Work Plan included two subsistence scenarios, Traditional and Modern, to represent the STI and the CCT, respectively (U.S. EPA, 2009). The STI developed exposure parameter values for traditional subsistence exposure scenarios (Harper et al., 2002; U.S. EPA, 2005a) to be used to assess the potential risk from exposure to contaminants. Those exposure parameters will be used to evaluate potential risk to the STI population in the baseline Site-wide HHRA. However, available information was not adequate to establish CCT-specific exposure parameter values for the residents of the Colville Reservation. The CCT population engages in fishing, hunting, and gathering activities (e.g., crops and other edible plants, fish, wild game, and livestock) within the Local Area, consume local resources as

[2] The CSM is included as Appendix A of this report.

food, and engage in activities on the UCR (including swimming, wading, kayaking, and canoeing). Activities within the UCR and Local Area include:

- Hunting, fishing, and gathering
- Building of shelters or other structures or large objects
- Sweat lodge construction and use
- Weaving, coloring and dyeing, and carving
- Food preparation, preservation, and consumption
- Medicinal, spiritual, or traditional practices

The primary goal of the Tribal Survey was to obtain CCT-specific data that would allow reliable identification and characterization of potential exposures of the residents of the Colville Reservation from subsistence or tribal cultural practices that involve hunting, fishing, gathering, and utilization of environmental resources from the UCR Site. A secondary goal of the study was to identify and prioritize potential data collection efforts for measuring concentrations of COIs in foods and other environmental resources harvested from the UCR Site that are utilized by the CCT population. A description of the DQOs for the Tribal Survey can be found in the UCR Tribal Survey Work Plan (U.S. EPA, 2010). As described in Section 2, the Tribal Survey collected data on the use of resources located within the Local Area.

Environmental sampling in the UCR initially focused on collection and chemical analyses of river water, sediment, and fish tissue samples (CH2MHill, 2007; Exponent, 2013a, 2013b; U.S. EPA, 2005b, 2006, 2013; TAI, 2013, 2014, 2016; Windward, 2017). Since the Tribal Survey was conducted, collection and chemical analysis of soil, shellfish tissue, and cultural/wild plant tissue has occurred as well in support of the RI/FS and HHRA (CH2MHill, 2016; TAI, 2015a, 2015b, 2016, 2017a, 2017b, 2017c, 2018, 2019).

The key data requirement needed to support reliable calculations of current risks to the CCT population is the current long-term average contact rate for each exposure medium of potential concern. Because exposure to environmental media may vary as a function of seasonal patterns, the Tribal Survey collected data over 18 consecutive months to allow reliable estimation of long-term average contact rates. Also, exposures are expected to vary between different individuals, so efforts were made to survey a relatively large percentage of the CCT population to fully characterize the population distribution of exposures. This will allow estimation of a CTE and an RME. The CTE represents the typical or "average" exposure in the population. The RME represents exposures that are at the upper end of the population distribution (e.g., 95^{th} percentile [P95]). In addition, exposure and risk may depend on person-specific variables (i.e., proximity to the site, age, sex, etc.). Information on these potential factors was collected to estimate exposures for subpopulations that may have atypical exposures. For instance, individuals that practice a traditional lifestyle and obtain a larger portion of their resources from the local environment were targeted. It is assumed that this subpopulation may be vulnerable to potentially higher exposures to COIs in Site-related media due to increased contact and consumption of resources located within the Local Area.

2.2 Study Population

The target population included all current residents of the Colville Reservation (Figure 1), as assessed at the time of household screening (November 2009–June 2010). Dwelling units in the survey area were assigned to each of 94 segments, each containing no more than 100 dwelling units and no larger than 30 square miles. The primary basis for the list of dwelling units was the enhanced 911 (E911) lists for Ferry and Okanagan Counties. The E911 lists were checked and supplemented with physical verification of dwellings on a subset of segments (including more populated areas), and review of Google Earth maps and other satellite imaging as described in U.S. EPA (2010).

2.3 Tribal Survey Exposure Pathways and Exposure Factors

The Tribal Survey provided information that will be used to help determine the exposure pathways to be considered in the HHRA, including ingestion, dermal contact, and inhalation exposure. The survey collected data that will be used to estimate long-term rates of daily food consumption and contact rates with exposure media identified in the UCR HHRA Work Plan as potential data gaps (U.S. EPA, 2009) (Table 1). Some of these consumption rates and contact rates will be used to calculate Human Intake Factors (HIFs) in the HHRA; these are intake rates that provide the mass or volume of media that are ingested, inhaled, or adheres to skin over a period of time.

Table 1. Colville Reservation Resident Exposure Parameters That May be Obtained from the Tribal Survey

Exposure Pathway	Exposure Parameter
Incidental ingestion and dermal contact with soil, sediment and surface water while swimming, wading, boating, hiking, or camping	• Exposure frequency (EF): Total number of days of activity per year • Exposure Time (ET): Duration of activity (hours/day) • Fraction of time engaged in activity within the Local Area
Consumption of foods derived from the Local Area (e.g., crops or other edible plants, fish, game, livestock)	• Total number of meals of food item per year • Meal size (mass of food item per day) • Daily consumption rates (DCRs) • Fraction derived from the Local Area
Incidental ingestion and dermal contact with soil, sediment or surface water while hunting, fishing, gathering plants, root digging, gardening, and gathering other natural materials	• EF: Total number of days of activity per year • ET: Duration of activity (hours/day) • Fraction of time engaged in activity at Local Area
Inhalation of materials used in sweat lodges (e.g., surface water, plants)	• EF: Total number of sweat lodge uses per year • ET: Duration of sweat (hours/day) • Fraction of sweat lodge materials derived from Local Area
Contact with plants or animals in construction of shelters or other large structures	• EF: Total number of days of activity per year • ET: Duration of activity (hours/day) • Oral contact with materials • Fraction of materials derived from Local Area
Contact with animals or plants used in weaving (including coloring or dying) or carving	• EF: Total number of days of activity per year • ET: Duration of activity (hours/day) • Oral contact with materials • Fraction of materials derived from Local Area

Table 1. Colville Reservation Resident Exposure Parameters That May be Obtained from the Tribal Survey

Exposure Pathway	Exposure Parameter
Contact with materials (e.g., animal, plant, or minerals) used in medicinal, spiritual, or traditional practices including face and body painting	• Description of how the material is used (e.g., potential route of exposure) • EF: Total number of events per year • ET: Duration of activity (hours/day) • Oral contact or body areas exposed to material • Fraction of material derived from Local Area

2.4 UCR Exposure Areas

The UCR has been divided into six river reaches (River Reaches R1–R6) that correspond to relatively distinct physiographic units (U.S. EPA, 2009) and are located within the Local Area (see Figure 1). Boundaries for the six river reaches were selected based on distinct geomorphic features (e.g., channel width, sinuosity, confluence with major tributaries), general hydraulic or hydrodynamic characteristics (depth, location of the reservoir pool, riverbed characteristics, flow velocity), and expected differences regarding the principal mechanisms for transport or deposition of particle-bound COIs (U.S. EPA, 2009). River reach designations are:

- **River Reach 1** extends from the U.S.-Canada border (U.S. Geological Survey [USGS] River Mile [RM] 745) southward past the city of Northport to USGS RM 730, near Onion Creek.
- **River Reach 2** extends from near Onion Creek (USGS RM 730) to Evans (USGS RM 711).
- **River Reach 3** extends from Evans (USGS RM 711) to just downstream of Kettle Falls (USGS RM 699).
- **River Reach 4** extends from just downstream of Kettle Falls (USGS RM 699) to just upstream of the confluence with the Spokane River (USGS RM 640) and represents the middle reservoir. This reach is further divided into two sub-reaches:
    - **River Reach 4A** extends from USGS RM 699, at the confluence of the Colville River, to USGS RM 676, just upstream of Inchelium.
    - **River Reach 4B** extends from USGS RM 676 to USGS RM 640 near the confluence with the Spokane River and borders the Spokane Reservation.
- **River Reach 5** extends from USGS RM 640 to USGS RM 617. Within this reach, the Spokane River joins the Columbia River at USGS RM 639. This reach borders the Colville Reservation.
- **River Reach 6** extends from USGS RM 617 to the Grand Coulee Dam (near USGS RM 597). This reach borders the Colville Reservation.

Other rivers located within Local Area are listed below and shown in Figure 1; they are not part of the UCR:

- **River Reach 7:** Columbia River
- **River Reach 8:** Okanogan River
- **River Reach 9:** Banks Lake
- **River Reach 10:** Sanpoil River

- **River Reach 11:** Lower arm of the Spokane River
- **River Reach 12:** Colville River
- **River Reach 13**: Kettle River

3.0 SURVEY DESIGN

3.1 Overview

A complete description of the design and implementation of the Tribal Survey is provided in the Tribal Survey Work Plan (U.S. EPA, 2010) and the *Upper Columbia River Remedial Investigation and Feasibility Study Tribal Consumption and Resource Use Survey, Final Report* (Westat, 2012a). This section is intended to provide an overview of the design features that are pertinent to understanding the data analyses presented in this report.

3.2 Survey Instruments that Comprise the Tribal Survey

Four types of survey instruments were administered over a period of approximately 16 months, from November 2009 to March 2011:

- Household Screening Survey. This instrument was used to enumerate and record demographic information (e.g., age, sex, and date of birth) for all persons living in dwelling units on the Colville Indian Reservation for purposes of selecting household members for study participation and assigning sample weights to survey participants.
- Automated Multiple Pass Method (AMPM) Interviews. Respondents completed two to four 24-hour dietary recall AMPM[3] interviews as part of the overall study. These computer-aided surveys were intended to characterize the types and amounts of food ingested by survey respondents on up to four different days, each representing a different season of the year.
- Food Questionnaire (FQ). This questionnaire was administered once, at the end of the AMPM survey program. This survey was designed to collect information on the long-term average intake frequencies of specified food items, as well as the source and location of the food items (e.g., harvested, store bought).
- Resource Utilization and Practices Questionnaire (ReUP). This questionnaire collected information on a wide range of non-dietary exposures to potentially contaminated local natural resources for a range of activities, including medicinal uses, traditional tribal practices, food preparation, and production of clothing or household items.

Interviews were administered by CCT staff trained by Westat. Quality control reviews were conducted that included observations of interviews in the field, verification of at least 10% of all data collected by each interviewer, and review of collected data for anomalies (e.g., unexpected estimated daily caloric intakes or number of food items based on AMPM). All data were collected and/or recorded in an automated Survey Management System, which allowed the survey field supervisor to assign cases

[3] The acronym, AMPM, and phrase, 24-hour recalls, are used interchangeably throughout this report.

(i.e., people to be interviewed) and track progress, and allowed the interviewers to receive cases, complete and transmit AMPM interviews, and record survey results. The FQ and ReUP questionnaires are included in Westat (2012a). Each of these survey instruments is described in further detail below.

3.2.1 Household Screening Survey

Each dwelling unit was visited by survey staff to conduct a Household Screening. The purpose of the Household Screening was to determine if the dwelling unit was inhabited and, if so, to enumerate all persons living in the household. From this list of household members, a random sampling procedure was applied to identify individuals selected to participate in the survey in each household. This procedure is described in detail in Appendix A of U.S. EPA (2010). In brief, household members were divided into four age groups (0–6 years, 7–17 years, 18–54 years, and ages 55 years or older). Within each household, persons were randomly selected based on a predetermined sampling rate assigned to each household for each of the four age categories. The rate was developed based on demographic estimates from the summary files of the U.S. Census Bureau (2000) data on "Colville Reservation and Off-Reservation Trust Land." At the beginning of the survey, the following sampling rates were used to select individuals within households based on age. Only one person was selected from each age group within a given household based on age.

- 100% of households with 0- to 6-year-olds (i.e., 0 to <7 years old)
- 80% of households with 7- to 17-year-olds (i.e., 7 to <18 years old)
- 33% of households with 18- to 54-year-olds (i.e., 18 to <55 years old)
- 52% of households with ages 55 years or older (i.e., 55+ years)

As described by U.S. EPA (2010), these sampling rates indicated that every household with a child 0–6 years old would have 1 child selected for the survey. In 4 out of 5 households (80%) with children ages 7–17 years, 1 of those children would be selected for sampling. One 18- to 54-year-old adult would be selected from either households that had both 0–6- and 7–17-year age categories and where a 7- to 17-year-old would not be selected for the survey, or from households without children (0–6 or 7–17 years old). In households without children, 1 in 3 adults 18–44 years old would be selected. For households with adults aged 55 years or older, approximately half had someone who would be selected.

To manage fieldwork and to ensure that assumptions about response rates and prevalence of specific age groups in the population were accurate, Household Screening activities were divided into two waves. When the second wave was released to the field, the rates shown above were modified slightly to reflect actual experience gained during the first wave.

Sampled participants were limited to one per age category in a household. In addition, no more than two age categories were selected per household, except for persons in the 55+ age group. If, in a household, one person was sampled from both child age categories (0–6 and 7–17 years), no person between 19 and 54 years old was eligible to be sampled, although a person in the 55+ age group could still have been sampled. These restrictions were established to limit the burden placed on each household.

The maximum number of participants from each household was two people from the 0–54-year age groups (in accord with the subsampling frequencies for each age group) plus one person from the 55+

age group. If more than one person was eligible within a specific age group, then the survey participant was selected based on most recent birth month. Specific procedures for selecting eligible participants are described in the *Field Interviewer Manual of Procedures, Part I: Field Procedures* developed for the study (Westat, 2009a).

In addition to household members selected at random, individuals who reported to be practicing a more traditional subsistence lifestyle that might result in consumption of larger amounts of local resources were also selected to participate. These individuals ("heavy consumers") were defined as self-reporting eating local foods or taking part in traditional Native American practices more than three times per week. Heavy consumers were assumed to represent a smaller (but unknown) fraction of the total CCT population. Rather than relying on the random selection process to recruit these individuals, one individual who met the criteria of heavy consumer was invited to participate in the survey from each household. To avoid bias in the data analysis, these targeted individuals are uniquely identified in the survey database, and assigned a weight based on this selection criterion to distinguish them from participants selected at random.

3.2.2 Dietary Exposure Data Collection

Dietary exposure information was collected using the AMPM and FQ surveys. The AMPM was selected for use in the Tribal Survey because it is a validated instrument that has been used in the National Health and Nutrition Examination Survey (NHANES), as well as other large health surveys (U.S. EPA, 2010). The AMPM instrument automatically assigns unique food identifier codes to recorded responses that allow for linkages to national databases that can provide food-item specific information on nutritional content (e.g., the U.S. Department of Agriculture's [USDA's] Food and Nutrient Database for Dietary Studies [FNDDS] database) and chemical residue levels (e.g., U.S. Food and Drug Administration's [FDA's] Total Diet Study [TDS] database). The FQ was a modified Food Frequency Questionnaire (FFQ), which is a commonly used dietary assessment tool. A standard FFQ queries both the frequency of consumption and portion size over a defined period of time. The FQ used in this survey recorded frequency of consumption but not portion size, as very detailed portion size information was obtained from the AMPM.

Adults and children of all ages were eligible for the AMPM and FQ. A parent or guardian was asked to serve as a proxy for children ages 8 years and under. Beginning at age 9 years, children were encouraged to provide their own self-report, with assistance from a parent/guardian as necessary.

3.2.2.1 Automated Multiple Pass Method (AMPM)

The AMPM is a standardized, interviewer-administered 24-hour dietary recall developed by the USDA that uses computer-assisted personal interviewing (CAPI) techniques. The interview asks about foods and beverages consumed during the previous 24-hour period. The AMPM also includes questions about the source and preparation of the food. In addition to the list of foods that are standard to the AMPM, the instrument used for the Tribal Survey included an additional 57 local and indigenous foods identified by CCT resource experts. The AMPM includes all food items ingested in the previous day regardless of source (i.e., harvested from the UCR, harvested from the Local Area, harvested outside the Local Area, store bought). The AMPM was administered multiple times (up to four) over the data

collection period, although the majority of participants completed only two AMPMs. The AMPM was administered at different times over the course of 18 months to capture temporal (e.g., seasonal) variability in food consumption patterns; successive AMPMs were administered at least 70 days apart.[4]

3.2.2.2 Food Questionnaire (FQ)

The FQ was developed specifically for the Tribal Survey, based on a standardized collection methodology instrument (the FFQ). The minimum age for FQ eligibility was 2 years of age at the time of interview. This age was selected as the time at which children typically begin eating locally harvested foods. CCT resource experts determined the types of local and indigenous foods from the Local Area to be included in the FQ, as well as key data to be gathered regarding each food. The FQ asked how often each specific food was consumed during the past 12 months and where the food was obtained. Locations were identified by participants pointing to locations on a standardized map showing CCT resource zones (see Figure 1). The FQ was an interviewer-administered, hard-copy questionnaire on a scannable form.

3.2.3 Non-Dietary Exposure Data Collection – Resource Utilization and Practices Questionnaire (ReUP)

The ReUP captured information about non-dietary exposure to resources, such as outdoor activities (e.g., hunting, fishing, and gathering), tribal practices (e.g., sweat lodge use, basket weaving, and other cultural practices), and recreational activities performed. ReUP participants were asked about frequency, duration, and contact rates within the past year, as well as the types of materials (e.g., plant species and plant parts) that may have been utilized as part of these activities or practices. The traditional activities and resources from the Local Area that were included, and key types of data gathered regarding each were selected by CCT resource experts. The same mapping procedure that was used for the FQ was also used during administration of the ReUP to help the participants identify where they obtained the local resources and engaged in traditional practices and activities. The ReUP was administered at the end of the data collection period, usually in conjunction with the FQ. The minimum age for ReUP eligibility was 14 years old. This age was recommended by the CCT as the age at which children typically begin independently participating in traditional practices. The ReUP was an interviewer-administered, hard-copy questionnaire.

4.0 METHODS USED TO ESTIMATE EXPOSURE PARAMETER VALUES

4.1 Overview

This section describes the data reduction and statistical methods used to estimate long-term daily food consumption rates (DCRs), media contact rates (e.g., hours in contact with surface water), and time spent using natural resources from the Local Area as part of CCT cultural practices. This section also describes assumptions that were made during the data reduction and estimation steps, along with the

[4] There were a few exceptions to the 70-day separation between the second and third AMPM interviews. Nine participants had a third AMPM interview less than 70 days after their second interview; the minimum separation was 64 days.

rationale for those assumptions. Some of the parameter estimates presented in this report may be used in the UCR HHRA. The parameter estimates may also help determine which age groups to include in the HHRA, and whether separate risk estimates are required by sex. The HHRA will use both CTE and RME parameters representative of the exposed population (as recommended by U.S. EPA, 1989; Browner, 1995). The CTE is generally represented by an estimate of the mean of the population, and the RME is generally represented by an estimate of the P95 of the population.

Population estimates employed the sampling weights provided in the Westat database. The sampling weights were calculated for each participant of the survey. The weights were derived from the sampling plan and are proportional to the probability that the participant would be selected to participate in the survey. Detailed explanation of the sampling weight calculation is provided in U.S. EPA (2010) and Westat (2012a).

All estimates presented in this report are for "consumers only" (for food consumption) or "doers only" (for resource use). The food consumption estimates that are based on the FQ or AMPM pertain to the members of the subpopulation who consume that food item. The estimates presented based on the ReUP questionnaire are intended to represent members of the subpopulation who engage in the activity. These estimates were made using domain analysis where participants who are consumers/doers constitute one domain and non-consumers/non-doers were placed in the other domain.

4.2 Data Reduction

All survey data were provided by Westat as SAS data files on 4/10/2012. All database queries, data reduction processes, and parameter estimates were performed using SAS statistical software.[5]

The FQ data were reviewed to ensure proper coding of appropriate and inappropriate skipped questions. For example, participants who reported consuming a particular food item should have non-negative responses to subsequent questions about the frequency of consuming that food item and the source(s) of that food item (e.g., Local Area, store, etc.). In contrast, participants who reported they did not consume a food item should have responses equal to "-1" for subsequent questions about the frequency of consuming that food item. The results of these data reviews are presented in Section 5.2.8.

The AMPM data underwent a quality control review prior to delivery of the database to EPA (Westat, 2012a) and were the focus of a review provided by an independent third-party reviewer (The Mountain-Whisper-Light Statistics [MWL], 2016). The third-party review identified an error in a key field ("gramsDiv100") of the 24-hour recall data (MWL, 2016). This field was intended to provide the amount of each ingredient (e.g., fish) of a food item, as a fraction of the total weight of the food item. The product of the portion size (grams) and "gramsDiv100" was then used to calculate the mass of the ingredient that was consumed. The correction (see MWL, 2016 for details) has been incorporated in the database and in all dietary estimates presented in this report. Other recommendations provided by the third-party reviewer have been incorporated in the calculation and presentation of the estimates included in this report.

[5] SAS|STAT and SAS|Graph software version 9.3 of the SAS System for Windows. Copyright (c) 2002–2010 by SAS Institute Inc., Cary, NC, USA. All Rights Reserved; SAS|Enterprise Guide Version 5.1. Copyright (c) 2012 by SAS Institute Inc., Cary, NC, USA. All Rights Reserved

Many of the FQ and ReUP questions elicited categorical responses (e.g., "more than once a week"). These data were converted to numerical data using the conversion factors shown in Table 2. The conversion of responses to questions about the frequency of food consumption (e.g., FQ Questions 3, 4, 10, and 11) was consistent with the approach that is used in the National Cancer Institute's (NCI's) Diet*Calc software (Diet*Calc, 2005).[6] The first four columns in Table 2 are taken in whole or in part from the FQ or ReUP questionnaires. The fifth column (Numerical Range) shows the converted numerical values and the sixth column shows the converted values that were used to estimate the daily frequency.

Table 2. Conversion of Survey Responses for Use in Estimating Food Consumption Rates

Questionnaire	Question Numbers[a]	Response	Response Description	Numerical Range	Daily Frequency	Comments
FQ	3, 4, 10, 11… *How often did you eat the…*	1	Every day	1	1	
		2	More than once a week, but not every day	2/7 – 6/7	0.5714	4/7
		3	Once a week	1/7	0.1429	
		4	More than once a month, but not every week	2/30 – 3/30	0.0833	2.5/30
		5	Once a month	1/30	0.0333	
		6	Less than once a month	0/30 – <1/30	0.0167	0.5/30
		7	Never?	0	0	
		8	Don't know	0	0	
FQ	5, 6, 7… *How much of the…bought at a store… …caught outside/inside Local Area?*	1	All	1	1	Responses were adjusted to sum to 1 by dividing each by the sum of responses to all categories
		2	Most	0.75	0.75	
		3	Half	0.5	0.5	
		4	Some	0.25	0.25	
		5	Little	0.1	0.1	
		6	None	0	0	
		7	Don't know	0	0	
FQ	8a, 8b, 88a, 88b… *…caught within user specified zone/area?*	1	All	1	1	
		2	Most	0.75	0.75	
		3	Half	0.5	0.5	
		4	Some	0.25	0.25	
		5	Little	0.1	0.1	
ReUP	4a–d, 10a–d, 16a–d… *During the [Season], total number of days spent time… took part in [Activity]?*[b]	1	None	0		Values are summed across seasons to estimate events/year
		2	1–7 days	4		
		3	8–30 days	19		
		4	31–60 days	45.5		
		5	61–90 days	75.5		
		6	Every day	91.25 (=365/4)		
		7	Don't know	0		

[6] Diet*Calc software is used by the NCI to process data from the NCI Diet History Questionnaire, and by Centers of Disease Control, NCHS to process data from the FFQs that were administered as part of the NHANES.

Table 2. Conversion of Survey Responses for Use in Estimating Food Consumption Rates

Questionnaire	Question Numbers[a]	Response	Response Description	Numerical Range	Daily Frequency	Comments
ReUP	5, 11, 17, 26… *On the days you took part in these activities during the [Season], how many hours per day did you usually spend doing them?*[b]	1	Less than 1 hour	0.5	0.5	Values are averaged across season to estimate annual averages
		2	1–3 hours	2	2	
		3	4–7 hours	5.5	5.5	
		4	8 or more hours	10	10	
		5	Don't know	0	0	

[a]Not necessarily a complete list.
[b]Season = 3 months; a = winter; b = spring; c = summer; d = fall.

As described previously (see Section 3.2.2), the FQ collected data on the source of foods consumed by the CCT population ("food source data"). The food source data consist of two levels of detail: the first level provides the frequency that foods were purchased (e.g., at a store or restaurant), collected from areas outside of the Local Area or collected from inside the Local Area (e.g., Table 2, Questions 5–7). The second level of food source data provides more detail about the fraction of the food item that was from the Local Area (e.g., Table 2, Questions 8 and 88). The food source data were used with the food frequency data to estimate the frequency that foods were collected from individual CCT resource zones. The FQ data were also used to estimate the daily frequency of consuming foods sourced from the Local Area and to estimate the percentage of each food item that is sourced from the Local Area. These frequencies were estimated using the sampling weights and the *SurveyMeans* procedure in SAS|STAT.[7]

The food source data were normalized (after they were converted from categorical responses to numerical values) to ensure the frequencies summed to 1. For example, for each participant, the responses to Questions 5–7 were divided by the sum of the responses to these three questions so that they would sum to 1. If a participant's responses to Questions 5–7 (i.e., store, caught outside the Local Area, caught inside the Local Area) for a food item, for example, were "half" (0.5), "some" (0.25), and "little" (0.1), respectively, the frequencies would sum to 0.85; the adjusted frequencies would be 0.59, 0.29 and 0.12. Similarly, the converted responses to questions about the sources of food within the Local Area (e.g., Question 8) were normalized to sum to 1. The normalization was implemented for each food item (e.g., fish species, vegetable type).

The AMPM data were used to estimate long-term DCRs (grams/day) for foods that were potentially relevant to the UCR HHRA. The relevant food categories are freshwater finfish, wild game and waterfowl, wild plants, fruits and vegetables, livestock, and dairy. The approach used to assign AMPM data records to each food category is described briefly here; detailed descriptions of the queries that were used are provided in Appendix B.

The AMPM data file includes the ingredients for each food item reported to have been consumed by the participants on their 24-hour recall interviews. Data for 24-hour recalls that were flagged for not meeting the minimum quality criteria were not used in any of the food consumption estimates. The food

[7] SAS|STAT software version 9.3 of the SAS System for Windows. Copyright (c) 2002–2010 by SAS Institute Inc., Cary, NC, USA. All Rights Reserved.

commodity intake database (FCID) food codes, FNDDS food codes, and food modification descriptions were used to assign records (i.e., ingredients) to the appropriate food categories. The mass of each ingredient was calculated as the product of the amount of the food item (e.g., fish sandwich, in grams) and the amount of the ingredient (e.g., fish, provided as a percentage of the total food item mass). After selecting the appropriate records from the database, the total daily intake for each food category was calculated for each of the survey participant's recalls. These daily totals for each food category were used to estimate DCRs when possible.

4.3 Dietary Intake Estimation Methods

The target populations for all food consumption estimates are the subgroups who consume the food (i.e., the estimates are for "consumers only"). In all food consumption estimates presented in this report, consumers were defined as participants who reported consumption of the food item on their FQ or on at least one of their 24-hour dietary recalls (Westat, 2010).

The number of 24-hour dietary recalls that included the consumption of wild game (other than venison) or wild fruits and vegetables were too few to produce reliable estimates for long-term DCRs (Table 3). Statistics for the total daily consumption amounts ("meal sizes") for these food items are provided in Section 5. Except for fish and venison, as discussed in subsequent sections, sample sizes for child consumption frequency and meal size were very small, introducing a large amount of uncertainty into child DCRs. For these food items, a reliable estimate of DCRs for children may be derived by multiplying the estimated DCRs for adults by a ratio of children-to-adult dietary intake. The ratio of children-to-adult dietary intake could be estimated using estimated energy requirements for children and adults based on regression models presented in IOM (2005). These calculations will be done in the Site-wide HHRA.

Table 3. Summary of Dietary Consumption Data Report on the 24-Hour Dietary Recalls (AMPMs), Excluding Fruit and Vegetable Consumption Data

Food Category	Food Item	Sum of Sampling Weights	Number of People Reporting Consumption	Number of People Reporting Consumption on More than One Dietary Recall
Wild game and water fowl	Bear	2.3	1	0
	Elk	25	8	0
	Goose	3	1	0
	Moose	39	17	5
	Venison	882	202[a]	30[b]

Table 3. Summary of Dietary Consumption Data Report on the 24-Hour Dietary Recalls (AMPMs), Excluding Fruit and Vegetable Consumption Data

Food Category	Food Item	Sum of Sampling Weights	Number of People Reporting Consumption	Number of People Reporting Consumption on More than One Dietary Recall
Wild plants	Balsamroot	5	1	0
	Bitterroot	20	3	0
	Huckleberry	150	35	1
	Lomatium	25	4	0
	Wild blackberry	7	1	0
	Blueberry	1	1	0
	Wild onion	2	1	0
	Wild potato	2	1	0
	Wild raspberry	9	3	0
Livestock	Goat	4	2	0
	Duck	9	3	0
	Lamb	1248	243	34
	Turkey	2324	434	91
	Chicken	4255	818	319
	Pork	5048	971	546
	Beef	5563	1074	792
Dairy	Egg	5797	1130	962
	Cow milk	6037	1165	1151
	Goat milk	30	8	1
Human milk		63	11	5

[a]Of the 202 people who reported consumption, 23 were children (0–6 years old) and 179 were adults (>6 years old).
[b]Two of the 30 people who reported eating deer on more than 1 of their 24-hour dietary recalls were children (0–6 years old) and 28 were adults (>6 years old).

Dodd et al. (2006) provides an overview of the challenges of estimating long-term average dietary intake with 24-hour recall data. Much of the difficulty is due to the day-to-day variability of the diet of most people. The challenge is greatest for foods that are consumed infrequently (e.g., fish); as the frequency decreases, the amount of data available to estimate consumption amount decreases. The FQ was included in the Tribal Survey to provide information on the frequency of food consumption over a longer period (12 months). The FQ included questions about foods of interest to the CCT population (e.g., game) as well as foods that are more commonly consumed.

U.S. EPA (2010) describes the use of a statistical method developed at the NCI to estimate dietary intake for the HHRA. Research has shown that the NCI method provides improved estimates of long-term DCRs, particularly in the tails of the distribution, for food items that are not consumed every day (Subar et al., 2006; Tooze et al., 2006). The NCI model consists of two models: a probability model that estimates the probability of consumption, and an amount model that estimates the amount (mass) of a food item that is consumed on days the food is consumed. In addition, the NCI method is able to use long-term food frequency data from FQs as a covariate to the probability model, or amount model, or both (e.g., Subar et al., 2006). Other covariates, such as age and sex, may also be included in one or both

models. The Tribal Survey was designed to support application of the NCI method (U.S. EPA, 2010); however, its application, as described below, was limited to foods that were reported on an adequate number of AMPMs: fish, eggs, cultivated (not wild) fruits and vegetables, livestock, milk, and venison. The method was implemented using SAS macros available from the NCI website (NCI, 2018).

For foods that are consumed with high frequency, the amount-only model may be used (MWL, 2016; NCI, 2018). Potential covariates for the NCI model were evaluated prior to selecting the final form of the model that was used to estimate DCRs. These covariates included bins defined by the age-sex categories included in the sample design (0–6, 7–17, 18–54, and 55 years old or older) and sex of the participant; the age categories that will be used in the HHRA (children: 0–6 years old, adults: 7 years and older); the combination of participant's sex and the HHRA definitions of children and adults; only the sex of the participant; and models with no covariates. The model estimates were compared using the Akaike information criterion (AIC)[8], the ratio of the estimated (NCI model) parameter values for within-person variance and between-person variance, and visual inspection of the estimates. Based on the comparison of alternative model results for the livestock data, the list of potential covariates that were evaluated for other food items (eggs, cultivated fruits and vegetables and milk) were limited to the eight age-sex categories included in the sample design and the categories that will be used in the HHRA (children and adults). For all foods except venison and freshwater finfish, the final NCI models included the eight age-sex categories from the sample design as the only covariate.

The correlated NCI model (i.e., using both the probability part and amount part of the model) was used to estimate DCRs for venison. Given the limited number of participants who reported consumption of venison on more than one AMPM, the potential covariates evaluated for the venison NCI models were limited to different forms of the FQ (untransformed and log-transformed). The effect of imputing values for missing FQ data was also evaluated. The final NCI model used to estimate DCRs for venison did not include any covariates; details are provided in Section 5.2.4.1.

Estimation of daily fish consumption rates with the NCI model estimates are described in the next section. Additional details of the approach are provided in Appendix C.

4.3.1 Estimating Fish Consumption

The data used to estimate DCRs for freshwater finfish were derived from the AMPMs, which provided data for the size of fish meals (i.e., how much fish is consumed when it is consumed), and the FQ, which provided data for the frequency of fish consumption. Summary statistics for freshwater finfish meal sizes are presented in Table 4. The fish meals were reported on 138 24-hour dietary recalls by 123 participants (Table 4). Twelve participants reported freshwater finfish consumption on more than one AMPM. Foods that included trace amounts of fish (<1%) were not used; e.g., these data include cheese spread that includes freshwater fish as a minor ingredient (<0.001 grams per meal). The file also does not include a meal that included the food item: "dumpling, steamed, filled with meat, poultry or seafood;" although the food item includes an FCID code for freshwater finfish, the food description does not specify a particular fish species and the food item contained just 1.8 grams of fish.

[8] Akaike information criterion (AIC) is a statistical evaluation of the relative quality of models for a given set of data. When multiple models are available, the AIC provides a means for model selection.

Table 4. Summary Statistics for Meal Sizes[a] for Freshwater Finfish (grams)

Age/Sex Group	N	Mean	SE[b]	LCL95[c]	UCL95	Minimum	Maximum	SD[d]	CV[e]
0–17 years, male and female	13	99	20	89	110	19	270	71	72
>18 years, female	65	130	14	130	130	3	590	110	85
>18 years, male	60	200	19	200	200	8	660	150	75
All ages and sex combined	138	160	11	160	160	3	660	130	81

[a]The data for each participant were reduced to the total fish consumption reported on each AMPM interview. AMPM interviews that did not include fish consumption were not included in the calculation of the summary statistics presented in this table.
[b]SE = standard error for the mean.
[c]LCL95 = P95 lower confidence limit (LCL) for the mean; UCL95 = P95 upper confidence limit (UCL) for the mean.
[d]SD = estimated population standard deviation.
[e]CV = estimated population coefficient of variation (= SD/mean).

The NCI model (i.e., using both the probability part and amount part of the model) was used to estimate DCRs for freshwater finfish (MWL, 2016) using data provided by the FQ and the AMPMs. While Table 4 provides statistics for meal sizes (i.e., the amount of fish consumed when it is consumed), the NCI model was used to combine the data for meal sizes (from the AMPM) with data for the frequency of consuming fish (from the FQ) to estimate DCRs for freshwater finfish (see Table 8 in Section 5.2.2). The potential covariates for the NCI model estimates that were evaluated included the FQ data, age and sex of the participants, the potential variation in consumption rates between weekends and weekdays and the interview sequence. Given the limited number of participants who reported consumption of fish on more than one AMPM, age-sex of the participants were grouped into three categories: 0–17 year old male and female; females 18 years and older; and males 18 years and older. After some trial and error with fitting models using the potential covariates, the model with these three age-sex categories was selected to estimate the DCRs for freshwater finfish. Estimates are presented in Section 5.2.2 for the three age-sex categories, and for all fish consumers combined.

Additional details of the model fitting, sensitivity analyses and calculation of the confidence interval are provided in Section 5.2.8 and Appendix C.

4.3.2 Other Dietary Estimates

Table 3 provides a summary of the data available to estimate dietary consumption rates. As shown in Table 3, except for venison, the AMPM data for wild game did not support inference of DCRs for the population of consumers. A detailed description of the data and application of the NCI method for estimating daily venison consumption rates is provided in Section 5.2.4.1.

The data available from the AMPM wild plants did not support estimation of DCRs for the population of consumers (Table 3). Statistics for wild plant consumption are provided in Section 5.2.7.

Except for goat and duck, the AMPM data available for the consumption of livestock were sufficient to estimate DCRs (see Table 3). Consumption of eggs and cow milk were reported on almost every AMPM (see Table 3); daily consumption estimated with the NCI method are provided in Section 5. The AMPM data for the consumption of goat milk were not sufficient to produce reliable estimates for

the daily consumption of goat milk; statistics are provided in Section 5. The AMPM did not collect data on the amount of breast milk consumed.

As described in Section 5, the frequency of consuming cultivated fruits and vegetables was adequate to estimate daily consumption with the NCI method (see Table 5). A DCR for total fruits and vegetables (combined) was estimated using the NCI method. The USDA food codes were used to place fruits and vegetables into one of the following categories:

- ***Flower/Seed*** – Plants in which the fruit and/or seed portion of the plant is consumed by humans and that are classified as vegetables for culinary purposes were placed in this category. Examples include avocados, cucumbers, nuts, peppers, pumpkin, squashes, sunflower seeds, and tomatoes.
- ***Fruit*** – This category includes foods that are considered a fruit for culinary purposes (not all foods that are botanically considered a fruit are in this category). Examples include apple, banana, berries, coconut, grapes, pineapple, and pomegranate. Vinegar was included in this category, as the majority of vinegars are made from plants that would be found in this category.
- ***Grasses/Grain*** – This category includes monocot plants in which the seed is the commonly eaten part of the plant. Examples include barley, corn, oats, rice, and wheat.
- ***Herbs/Spices*** – Plants that are considered an herb or spice for culinary purposes (not all plants that are botanically considered an herbaceous plant are in this category) were placed in this category. Examples include basil, cilantro, cinnamon, dill, and black pepper.
- ***Legumes*** – Foods that are the fruiting body of plants in the *Fabaceae* family were assigned to this category. Most have multiple seeds that are carried inside a pod or shell. Examples include black beans, chickpeas, kidney beans, lentils, peanuts, peas, and soybeans.
- ***Protist/Fungi*** – This category includes edible organisms that are part of the Protista or Fungi kingdoms. Examples include mushrooms and seaweed.
- ***Roots*** – This category includes vegetables in which the edible portion is located underground (for some plants in this category, the part of the plant that is eaten may not botanically be the root structure of the plant). Examples include beets, carrots, garlic, onions, parsnips, potatoes, radishes, and sweet potatoes.
- ***Stem/Leaf*** – Vegetables in which the part of the plant that is generally eaten is either the leaf or the stem structure of the plant were placed in this category. Examples include asparagus, broccoli, cabbage, cauliflower, celery, kale, lettuces, rhubarb, and spinach.
- ***Sugars*** – This category refers to a class of chemically-related sweet-flavored substances that are extracted from plants. Chemically, they are primarily fructose, glucose or sucrose. Examples include sugarcane, honey, and maple sugar. As sugars are not generally considered fruits or vegetables, DCR estimates for fruits and vegetables were made including and excluding this group.

Table 5. Fruit and Vegetable Data Summary by Food Category

Food Category	Food Item	Sum of Sampling Weights	Number of People Reporting Consumption	Number of People Reporting Consumption on More than One Dietary Recall
Flower/seed	Alfalfa	23	3	0
	Avocado	215	37	1
	Cocoa	1645	334	57
	Cottonseed	5958	1154	1082
	Cucumber	1718	316	47
	Eggplant	16	3	0
	Flax seed	30	7	1
	Nut	1812	360	85
	Okra	9	2	0
	Olive	2697	510	116
	Palm	411	74	1
	Pepper	4081	786	303
	Psyllium	7	1	0
	Pumpkin	124	18	0
	Rapeseed	5857	1128	928
	Safflower	5802	1114	877
	Sesame seed	2774	520	119
	Summer squash	213	40	1
	Sunflower	5809	1116	886
	Tomatillo	81	8	1
	Tomato	4771	936	476
	Water chestnut	98	19	1
	Winter squash	150	26	2
Fruit	Apple	3171	608	188
	Apricot	227	45	0
	Banana	1659	327	71
	Berry	1285	255	26
	Cherry	614	130	10
	Citrus	2507	498	126
	Coconut	1272	248	44
	Cranberry	561	97	8
	Currant	2	1	0
	Date	54	15	1
	Fig	59	10	0
	Grape	2488	486	128
	Guava	82	14	0
	Kiwi	51	6	0
	Lychee	9	1	0
	Mango	102	16	0
	Melon	722	133	5
	Nectarine	101	15	0
	Papaya	128	24	0

Table 5. Fruit and Vegetable Data Summary by Food Category

Food Category	Food Item	Sum of Sampling Weights	Number of People Reporting Consumption	Number of People Reporting Consumption on More than One Dietary Recall
	Passion fruit	159	26	1
	Peach	1445	287	47
	Pear	897	177	17
	Pineapple	872	172	14
	Plum	136	30	3
	Pomegranate	43	6	0
	Vinegar	3719	706	255
Grasses/grain	Amaranth	6	2	0
	Barley	3036	588	194
	Buckwheat	7	1	0
	Corn	5957	1148	994
	Oat	2918	577	200
	Rice	4167	807	325
	Triticale	7	1	0
	Wheat	5972	1155	1067
Herbs/spices	Basil	2752	538	148
	Cilantro	2593	482	102
	Cinnamon	2182	408	87
	Coriander	2036	386	77
	Dill	520	103	6
	Marjoram	3447	667	219
	Other herbs	3365	646	197
	Other spices	4361	830	347
	Parsley	247	50	3
	Pepper, black and white	3126	620	172
	Savory	2724	533	147
Legumes	Black bean	40	7	0
	Chickpea	20	5	0
	Great northern bean	416	82	2
	Green bean	1316	256	30
	Guar	1391	280	52
	Kidney bean	141	30	0
	Lentil	3	1	0
	Lima bean	219	52	2
	Mung bean	279	53	2
	Navy bean	430	84	3
	Pea	1055	191	21
	Peanut	3674	714	254
	Pink bean	3	1	0
	Pinto bean	780	147	9
	Soybean	5967	1156	1092
	Tamarind	636	126	6

Table 5. Fruit and Vegetable Data Summary by Food Category

Food Category	Food Item	Sum of Sampling Weights	Number of People Reporting Consumption	Number of People Reporting Consumption on More than One Dietary Recall
Protist/fungi	Mushroom	1005	170	13
	Seaweed	1406	285	51
Roots	Arrowroot	83	20	3
	Beet	5789	1123	891
	Carrot	2691	538	148
	Cassava	2850	568	156
	Chicory	179	38	0
	Garlic	3795	720	249
	Ginger	2769	510	118
	Horseradish	56	12	1
	Jerusalem artichoke	3	1	0
	Onion	5232	1015	616
	Potato	5400	1039	639
	Radish	131	29	1
	Rutabaga	37	9	0
	Sweet potato	96	18	1
	Turmeric	1153	222	27
	Turnip	16	1	0
Stem/leaf	Artichoke	12	4	0
	Asparagus	107	23	0
	Bamboo	17	2	0
	Broccoli	504	103	10
	Brussels sprouts	15	2	0
	Cabbage	665	121	11
	Cactus	28	2	0
	Cauliflower	213	44	2
	Celery	3259	638	184
	Leaf vegetable	2967	595	175
	Rhubarb	60	10	0
Sugars	Corn syrup	5708	1113	918
	Honey	2349	462	115
	Maple	16	3	0
	Sugarcane	5789	1123	889

4.3.3 Merging Food Residue Data

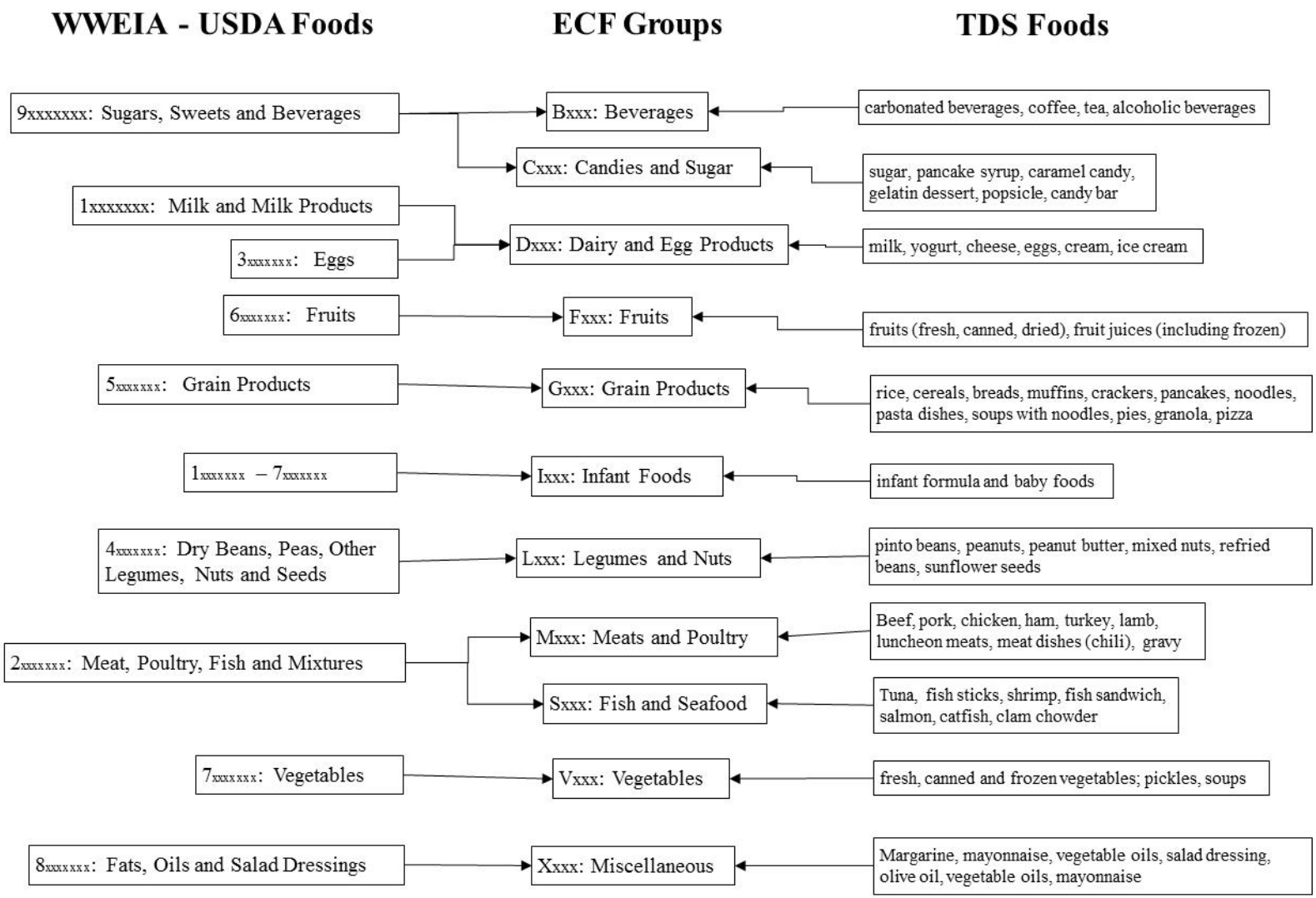
The AMPM data files delivered by Westat (Westat, 2012b) included pesticide residue data from the USDA Pesticide Data Program (PDP) database (USDA, 2011; Westat, 2010). The PDP data are concentrations measured in the raw commodity and do not necessarily reflect the concentration in foods as they are eaten. The commodities sampled and the pesticides included in the PDP vary from year to year (Westat, 2010). Concentrations below the limit of detection were converted to zero. The PDP data in the AMPM database are the average of the sample results that exceeded their detection limits. Because the majority of these data were below detection limits, they were not merged with the Tribal Survey database.

Metals concentration data from the TDS were merged with the AMPM food consumption data to estimate the dietary metal intake. Two types of dietary metal intake estimates are of interest. The first is an estimate of the total dietary intake of metals that would be expected if all the foods were purchased from a store or restaurant. The second type is an estimate of lead intake associated with certain foods of interest to the CCT (e.g., fish or vegetables grown within the Local Area). Both types of estimates use data from the TDS. The TDS is an ongoing U.S. FDA program that has measured the level of nutrients and contaminants in food consumed in the U.S. since 1961 (Egan, 2002). The TDS measures the concentration of contaminants in 260–290 foods as they are consumed. The ingredients for the foods are collected in four "market basket" surveys per year (once each in four geographic regions of the country). Each of the sampled foods has been assigned a TDS food number. The data are publicly available from the USDA's Center for Food Safety and Applied Nutrition, Office of Food Safety (USDA, 2013).

A USDA food code from the FNDDS database was assigned to each food included in the AMPM database. In general, the USDA foods cannot be matched directly with the TDS food numbers; there are many more USDA foods than there are TDS foods. To estimate the total dietary intake of metals, the TDS data were mapped to the AMPM data using Exposure Core Foods (ECFs; Tomerlin et al., 1997).[9] Figure 2 depicts an overview of the approach.

Several years of the TDS data were used to estimate the mean concentration of metals residue for each of the TDS food numbers. The TDS data were analyzed to determine the number of years of data to use for each metal. The preference was to use the most recent data; however, for metals that exhibit fairly constant average annual concentrations, up to 10 years of the most recent data available at the time of the analysis were used to increase precision of the estimate of the mean concentration that is merged to the AMPM database. Non-detects were replaced by half the limit of detection, and results reported as "trace" (i.e., between the limit of detection and the limit of quantitation) were not adjusted. ECF groups with more than one TDS food mapped to them were assigned the mean lead concentration for those TDS foods.

[9] The What We Eat In America (WWEIA) dietary survey is administered during the NHANES. The ECF groups were created for the U.S. EPA dietary exposure potential model (Tomerlin et al., 1997) to connect consumption data from the 1997–1978 and 1987–1988 Nationwide Food Consumption Surveys and the 1989–1992 USDA Continuing Surveys of Food Intake by Individuals to food residue data from the U.S. FDA TDS. The FDA's TDS has been monitoring contaminant levels in foods since 1961 (Egan, 2002, 2007) through their "Market Basket" surveys that are conducted in different regions of the country on a quarterly basis (i.e., every 3 months).



Note: WWEIA = What We Eat in America; ECF = Exposure Core Food; TDS= Total Diet Study

Figure 2. Mapping food consumption data to food residue data using the approach developed by Tomerlin et al. (1997).

4.3.4 Outlier Detection and Extreme Sampling Weights

The AMPM data that were used to estimate DCRs with the NCI method were evaluated to identify potential statistical outliers using the MM method in the SAS RobustReg procedure (SAS, 2017; Yohai, 1987). To be consistent with the NCI method, the outlier analysis was performed using the AMPM data for positive consumption amounts.[10] The outlier analysis should be considered a sensitivity analysis of the DCR estimates that are presented in this report using the NCI method. The results of the outlier analysis are presented in Section 5.2.8.

As part of the uncertainty assessment, the effect of potential statistical outliers on parameter estimates was evaluated by substituting two alternate sample weights. The two alternate sample weights that were used for potential outliers were 1.0 and the median of the sample weights. Changing the sample weights to 1.0 for participants who provide extreme responses is a standard method for treating extreme observations for participants who may be unique members of the population or domain of interest (Brewer, 2002). However, substituting 1.0 for sample weights for potential statistical outliers represents an extreme adjustment for the CCT survey as the median of the sample weights ranges from 3 to 4, depending on the food item. Therefore, the sensitivity of the parameter estimate to potential outliers was assessed by substituting both 1.0 and the median of the sample weights for responses that were identified as potential statistical outliers.

The effect of extreme sampling weights on the parameter estimates was also evaluated. Sampling weights that exceeded the median sample weight by six interquartile ranges were evaluated to determine if they had an undue influence on parameter estimates. The choice of the median plus six times the interquartile range has been used by others (e.g., IEc, 2013) although other cutoffs have also been suggested (e.g., Bataglia et al., 2004; Potter, 1988, 1990). Results of these evaluations are presented in Section 5.2.8.

4.4 ReUP Estimation Methods

Data from the ReUP were used to calculate exposure parameters for non-dietary exposure pathways. The data from the ReUP were used to estimate the population distribution for exposure frequency (EF) and exposure time (ET).

The EF data consist of participant's recalls of the number of days they engaged in an activity or used specific resources in the 12 months preceding the ReUP interview. The ET data capture the hours per day that a participant engaged in a practice, on days they engaged in the practice. These distributions were used to select CTE and RME parameters for use in exposure and risk calculations in the HHRA.

4.4.1 Tribal Practices

The ET and EF data for the tribal practices exposure scenario in the HHRA Work Plan (U.S. EPA, 2009) describe the hours and days, respectively, spent using the material while engaging in a

[10] The NCI method transforms the AMPM data using a Box-Cox transformation of the data for AMPMs that include reports of consuming the food item. The AMPMs that do not include consumption of the food item are represented in the data analysis as zeroes; they are not used to estimate the Box-Cox transformation parameters (Tooze et al., 2006).

tribal practice over the 12 months preceding the survey. These estimates of ET and EF do not include the time spent gathering the material.

4.4.2 Resource Uses

The ReUP included questions grouped into three subsections that addressed activities: in water (e.g., swimming), on water (e.g., boating), and on land (e.g., gardening). For each of these three subsections, the data include a list of activities that each participant reported engaging in over the 12 months preceding the ReUP interview. Participants were asked to provide one EF per season (days per season) and one ET per season (hours per day, for each season) for each of these three types of activities; i.e., the reported EF and ET apply to the general type of activity, rather than to specific activities that fall within the activity type. ETs and EFs were estimated using the sampling weights and the *SurveyMeans* procedure in SAS. ETs and EFs were estimated for "in water," "on water," and "on land" activities, by age categories and sex. Confidence intervals for the mean were calculated with a Taylor series method and tolerance intervals for the P95s were estimated with Woodruff's method (SAS, 2017).

The sections of the ReUP that collected data on weaving and construction materials also provided data for mouthing frequency. These data consist of yes/no responses (e.g., "…do you ever put the [material] in your mouth?") that were used to estimate the frequency of oral exposure. Population estimates for the rate of mouthing behavior were estimated by dividing the sum of the sampling weights for participants who reported engaging in the mouthing behavior by the sum of participants who completed the ReUP.

4.5 Spatial Analysis – FQ and ReUP

The FQ data include responses to questions about the frequency that each food item was obtained from within the Local Area. These responses were used with the daily frequency of consumption data to estimate the frequency that the population consumes the food item when it is from the Local Area. Maps were created using the *SurveyMeans* and GMAP procedures in SAS|STAT and SAS|Graph software.[11] The CCT provided a digital file of the CCT resource zones in ESRI shapefile format. The shapefile was converted to the SAS map format using the SAS *MapImport* procedure of SAS|Graph.[5] In general, each map shows an estimated total quantity (FQ = days, ReUP = hours) for the CCT population, for each of the CCT resource zones and river reaches.

The FQ data represent the estimated number of total days the CCT population ate foods that included an ingredient from the CCT resource zone. For each participant, the number of days for a food item was calculated as 365 (days) multiplied by the product of the daily frequency of consumption and the frequency the food item was from the Local Area. The weighted sums for each zone are estimates of the number of days the population consumed that food type from that resource zone. The sum of the weighted totals for River Reaches R1–R6 divided by the estimated number of days the CCT population consumed the food item provides an estimate of the frequency that the population obtains the food from the UCR or Lake Roosevelt. Similarly, the sum of all the CCT resource zones divided by the estimated

[11] SAS|GRAPH and SAS|STAT software version 9.3 of the SAS System for Windows. Copyright (c) 2002–2010 by SAS Institute Inc., Cary, NC, USA. All Rights Reserved.

total days for the population is the estimated frequency that the CCT population obtains the food item from the Local Area.

The mapped ReUP data for each participant is the product of ET and EF (hours/year). The calculations are similar to those described above for the FQ; one important difference is that all of the data collected from the ReUP pertain to the Local Area. For the surface water and "on land" activities, the weighted totals for each resource zone represent the total number of hours the population engaged in the activity within the zone. For all other estimates made with the ReUP data, the maps show the estimated total hours the population used a resource while engaging in a tribal practice (e.g., hours spent weaving with a plant obtained from that zone or zones).

5.0 RESULTS

5.1 Overview

A summary of population characteristics is presented in Westat (2012a). Key findings for the purposes of this report are summarized below.

The survey identified 3710 potential residential housing units, of which 45% were identified as ineligible (i.e., not a dwelling or vacant). Residents in 48% (1783) of the housing units were enumerated and 7% of potential dwelling units did not have an enumeration survey completed but may have been occupied. This corresponds to an 88.7% response rate for enumeration.

The 1783 housing units that completed enumeration included 4783 residents. From this group, 2645 individuals were selected for participation in the survey. Table 6 summarizes some demographic features of the sample. The age and sex distributions of the sample were very similar to the enumeration, as expected from the random sampling procedure. Heavy consumers (individuals who reported eating local foods or taking part in traditional Native American practices more than 3 times per week) comprised 51% of enumerated individuals and 65% of the individuals selected for the survey. In Table 6, *completed* refers to individuals who met the minimum requirements for the dietary surveys (i.e., completed at least two AMPM surveys and the FQ, described in greater detail in Section 5.2).

Table 6. Population Characteristics of the Tribal Survey Sample

	Enumerated		Sampled		Completed[a]	
Parameter	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Sex						
Female	2419	51	1362	51	640	55
Male	2364	49	1283	49	525	45
Total	**4783**		**2645**		**1165**	
Age (years)						
0–6	592	12	409	15	174	15
7–17	739	15	437	17	185	16
18–55	2141	45	1009	38	429	37
55+	1311	27	790	30	377	32
Total	**4783**		**2645**		**1165**	

Table 6. Population Characteristics of the Tribal Survey Sample

	Enumerated		Sampled		Completed[a]	
Parameter	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Heavy Consumer						
No	2324	49	929	35	376	32
Yes	2459	51	1716	65	789	68
Total	**4783**		**2645**		**1165**	
CCT Member						
No	2437	51	1260	48	531	46
Yes	2346	49	1385	52	634	54
Total	**4783**		**2645**		**1165**	

[a]Completed two or more AMPMs and the FQ (FQ was not collected if <2 years old) based on Westat (2011).

Of 2645 initially recruited for the survey, 1583 completed at least one AMPM and 1174 completed the FQ. Table 7 summarizes data on participation in the three survey instruments. Two or more AMPMs were completed by 1325 respondents, 696 completed 3 or more, and 16 completed 4 AMPMs. To estimate dietary intakes from the AMPM and FQ, minimum data requirements were completion of at least 2 AMPMs and the FQ; 1165 individuals met these minimum requirements.

Table 7. Summary of Participation in Tribal Survey

Survey Activity	Frequency	Percent (%)
Enumerated	4783	100
Selected	2645	55
Informed consent	1734	36
AMPM1	1583	33
AMPM2	1325	28
AMPM3	696	15
AMPM4	16	0.3
FQ	1174	24
ReUp	899	19

5.2 Dietary Exposure

5.2.1 Overview

All estimates presented are "consumer-only" estimates; consumers were defined as participants who reported consumption on the FQ or on at least one of their 24-hour dietary recalls (Westat, 2010). Estimates are provided for foods that are at least partially obtained from the Local Area (e.g., estimates of saltwater finfish are not provided). All estimates reported in Section 5 were calculated using the sampling weights unless otherwise noted.[12]

[12] Participants were selected with unequal probabilities (Westat, 2012a). Sampling weights are needed to produce unbiased estimates of the exposure parameters.

As stated in Section 4.3, the Tribal Survey was designed to use the NCI method for estimation of dietary intake. NCI estimates are provided when survey data were sufficient. The NCI estimates are recommended for estimating dietary intake. The NCI method, as implemented with SAS macros provided by NCI, does not produce standard errors (SEs) for parameters directly; however, SAS code may be written to incorporate the NCI macros within a resampling approach to produce SEs and/or confidence intervals for parameters (Kipnis et al., 2009). In general, the lack of confidence intervals was not considered an important drawback for this report as the primary purpose is to produce estimates for the HHRA, which typically uses means and upper percentiles, respectively, for CTE and RME estimates for DCRs, rather than upper confidence limits (UCLs) on a parameter (e.g., the 95th UCL of the mean). To evaluate the reliability of the NCI estimates of freshwater finfish DCRs, a resampling method was used to produce confidence intervals for the NCI estimates, as described in Section 5.2.2 and Appendix C.

Summary statistics of daily total food consumption amounts (on consumption days) are presented in Tables 9, 10, and 18 (in Sections 5.2.3, 5.2.4, and 5.2.8, respectively) for food items that did not appear on a sufficient number of AMPMs to support reliable estimates of DCRs with the NCI model[13]. To simplify the presentation of the estimates of daily total food consumption, the term "meals" is used rather than "consumption days;" the two terms are equivalent when a food is consumed once on the days that it is consumed. These statistics are not intended to be used to describe long-term DCRs. They describe the amounts consumed on days they were consumed ("consumption-day amounts"), whereas DCRs account for consumption-day amounts and days without consumption of the food item; i.e., DCRs consider both consumption-day amounts and the frequency of consumption.

The FQ provided data for the frequency of food items sourced from the Local Area (described in Section 4.2), which were used to estimate the proportion of the food items sourced from the Local Area by the consumers of the food item. These proportions may be combined with the NCI estimates for long-term daily consumption amounts to estimate DCRs for locally-sourced foods. The frequency of sourcing foods from the Local Area may also be combined with the FQ daily frequency of consumption data to estimate the daily frequency of consuming foods sourced from the Local Area, including the 13 river reaches shown in Figure 1. For example, a person who reported eating fish twice a month and reported sourcing approximately half of the fish from the Local Area would have a local daily frequency of consumption of once per month. The local daily frequency of consumption should not be used to estimate the mass of food consumed from the Local Area because the FQ does not provide information on the amount of the food item that is consumed when it is consumed. The local daily frequencies were also used to estimate the frequency that consumers source food items from a specified river reach or CCT resource zone. The data for the percentage of food items sourced from the Local Area may be combined with estimates of the DCRs (from the NCI model) to form approximate estimates of the DCRs for locally-sourced food items.

The FQ includes a small percentage of responses that identify one of the UCR reaches as the source of a dietary item when this appears to be incorrect (e.g., produce). The data are described as reported; however, this apparent source of uncertainty should be kept in mind when interpreting the results.

[13] The NCI estimates consider the amount of food that is consumed on days that it is consumed and the frequency that the food is consumed to derive a long-term average DCR. The statistics for the daily consumption amounts only consider the days the food item is consumed.

The estimates pertaining to activities (see Section 5.3), which are based on data from the ReUP, describe the use of/contact with resources from the Local Area. They do not describe the use of resources that are obtained from outside the Local Area or contact with media that are located outside the Local Area (e.g., contact with surface water located outside the Local Area).

5.2.2 Freshwater Finfish

The DCRs for freshwater finfish were developed by MWL (2016). A detailed description of the data that were used, the NCI model used to estimate the consumption rates, and an evaluation of the reliability of the freshwater finfish estimates is provided in Appendix C and briefly summarized below.

The final data file consisted of 910 participants who reported freshwater finfish consumption on the AMPM or the FQ. An evaluation of potential covariates in the NCI model, including the frequency of consuming finfish provided by the FQ, did not have a substantial effect on the daily fish consumption estimates (Appendix C). The AMPM interviews did not capture fish consumption by children <6 years old; therefore, the 0–6-year-old age category was combined with the 7–17-year-old age category to estimate DCRs for freshwater finfish. Daily fish consumption estimates are provided for the 0–17-year-old male and female fish consumers combined, for males 18 years old and older, for females 18 years old and older, and for the entire population of consumers combined (Table 8). The age-sex categories shown in Table 8 were the only covariates in the NCI model used to estimate freshwater finfish DCRs.

Table 8. Daily Fish Consumption Rates by the NCI Method

Age Group[a]	n	Mean[b] (grams/day)	LCL95	UCL95	Percentile						Local Daily Frequency (%)[c]	Percentage Sourced from Local Area (%)[d]
					P90	LTL90	UTL90	P95	LTL95	UTL95		
0–17 years, male and female	235	1.9	0.4	5.1	3.7	0.8	10.0	4.8	1.0	14.2	7.6%	73%
18+ years, female	373	7.0	4.1	10.6	13.5	7.4	22.6	17.2	8.8	32.7	8.2%	65%
18+ years, male	302	13.9	8.3	21.5	26.7	15.3	44.8	33.5	18.1	62.3	7.2%	71%
All ages	910	8.3	5.5	11.1	18.5	11.5	26.6	24.6	14.5	38.9	7.7%	69%

LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL90, UTL90 = lower and upper 90% tolerance limits for the P90; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95.

[a]Age groups included in the table are limited to the age groups that supported the estimation of fish consumption rates by the NCI method (MWL, 2017). The 24-hour dietary interview data for 0–6-year-olds would not support estimation of fish consumption rates.

[b]Detailed description of the fish consumption rate estimates and the simulation studies that were used to assess reliability and uncertainty are provided in Appendix C.

[c]Values were estimated with the FQ data; the estimate is the mean of the daily frequency of consuming food from the Local Area (i.e., the daily frequency of consumption × the frequency of obtaining the food item from the Local Area).

[d]Values were estimated with the FQ data; the estimate is the mean of the frequency of obtaining the food item from the Local Area.

Confidence intervals for the mean, 90th percentile (P90), and P95 (Table 8) were calculated using a parametric bootstrap approach (MWL, 2016). The estimated mean and P95 DCRs for all fish consumers combined are 8.3 and 24.6 grams/day, respectively. The estimated mean DCRs by the age/sex categories shown in Table 8 range from approximately 1.9 grams/day for 0–17-year-olds to 13.9 grams/day for males 18 years old and older. For fish consumers 18 years old and older, the estimated mean and P95 DCRs for males are approximately twice the estimated DCRs for females.

Approximately 80% (906) of the participants who completed the survey reported eating fish on the FQ. The daily frequency of finfish consumption from the Local Area was approximately 8% (i.e., finfish sourced from the Local Area was consumed on average once every 13 days) and approximately 69% of all finfish consumed was sourced from the Local Area (Table 8).

5.2.3 Shellfish and Other Aquatic Organisms

The 24-hour diet recall interviews did not capture the intake of shellfish sourced from the Local Area. The AMPM provided data for the meal size of market shellfish (clams, crab, and shrimp), which may provide a reasonable substitute for the meal size of locally-sourced shellfish. The FQ provided data for the daily frequency of consumption for mussels, crayfish and other aquatic organisms (Table 9). The mean and P95 of the daily frequency for consuming mussels from the Local Area was approximately 1.21% (approximately 4 days/year) and 1.67% (approximately 6 days/year), respectively. Crayfish were sourced from the Local Area with higher frequency than mussels: mean of 3.62% (13 days/year) and P95 of 8.33% (30 days/year). Many more people reported eating crayfish from the Local Area (n = 80) than mussels (n = 10).

Five people reported eating other aquatic organisms (e.g., frogs, snakes, turtles) that were sourced from the Local Area; the average frequency of consumption was approximately 6% (22 days/year). While consumption of other aquatic organisms from the Local Area was reported on the FQ, DCRs for other aquatic organisms could not be estimated because the AMPMs did not capture any reports of these foods.

Table 9. Consumption Frequency and Meal Size for Mussels, Crayfish, and Other Aquatic Organisms

Source	Food Item	n	Mean	Minimum	Maximum	P90	P95
Daily Frequency of Consumption (1/day)							
Local	Mussels	10	0.0121	0.0084	0.0167	0.0167	0.0167
	Crayfish	80	0.0362	0.0042	0.5710	0.0333	0.0833
	Other aquatic organisms[a]	5	0.0600	0.0167	0.0833	0.0833	0.0833
Local and not local	Mussels	71	0.0240	0.0167	0.0833	0.0333	0.0833
	Crayfish	91	0.0351	0.0167	0.5714	0.0333	0.0833
	Other aquatic organisms[a]	5	0.0600	0.0167	0.0833	0.0833	0.0833
Meal Size (grams/day)							
Not Local	Shellfish[b]	81	70.1	2.84	360	146	200

[a]Survey participants were asked if they had eaten "any meat, organs, or eggs from other aquatic animals, such as turtles, snakes, or frogs."
[b]Across all shellfish (includes foods reported on the AMPM that contained at least 1% clams, crab, lobster, oysters, or shrimp by weight).

5.2.4 Wild Game (Birds and Mammals)

Because of the low frequency of consumption of bear, elk, moose, and wild upland birds and waterfowl available in the AMPM database, population estimates of DCRs are not provided. The survey data for consumption of wild game other than venison are summarized in Table 10.

Table 10. Wild Game (Other than Venison) Meal Size Statistics

Food Item	Age Group (years)	n[a]	Mean (grams)	SE	Minimum (grams)	Maximum (grams)
Males						
Bear	18–54	1	71	–	71	71
Elk	0–6	1	48	–	48	48
	7–17	1	190	–	190	190
	18–54	1	31	–	31	31
	55+	2	99	23	76	123
Moose	0–6	1	68	-	68	68
	55+	3	100	15	85	130
Females						
Elk	7–17	1	72	–	72	72
	18–54	2	81	1	80	83
Moose	0–6	1	28	–	28	28
	7–17	2	118	22	96	140
	18–54	5	125	22	75	210
	55+	5	87	11	48	110

Note: The estimates/data shown above describe total daily consumption amounts (the same as meal sizes if the food item was only consumed once per day). The values shown above are not population estimates of DCRs. These data included only 24-hour recalls that reported consumption of the food item.
[a]The number of participants who reported consumption on at least one AMPM (U.S. EPA, 2010).

5.2.4.1 Venison Consumers

DCRs for venison (deer) were estimated using the NCI method. Participants who reported deer consumption on the FQ or on one or more AMPM (n = 916) were included in the venison consumer subpopulation (domain). Venison consumption was reported on at least one AMPM by 202 participants (179 adults and 23 children), and 30 participants reported consumption on more than one AMPM. As discussed previously (Section 5.2.1), the number of participants who report consumption on more than one AMPM is critical for estimating DCRs with the NCI model. The AMPM data included two children who consumed venison on more than one of their 24-hour recalls, which was not sufficient to estimate DCRs for children as a subgroup. Rather than estimate one DCR for children and adults combined, a DCR for adults was estimated. Data remaining to estimate venison consumption for adults included 782 adults; 28 of the adults reported consumption on more than one AMPM. The potential covariates in the NCI method included age, sex, and the daily frequency of venison consumption from the FQ. As recommended by the third-party reviewers (MWL, 2016), NCI models were estimated using the FQ data, including the untransformed daily frequency, the natural log of the daily frequency, and without using the

daily frequency as a covariate. The potential effect of missing values for daily frequency (from the FQ) on the DCRs was also evaluated (Section 5.2.9). The estimates for the DCR for venison by adults was based on a comparison of alternative specifications for the NCI model (Section 5.2.9 and Table D-1).

The mean and P95 of the DCR for adult CCT "venison consumers" are 12 and 42 grams/day, respectively (Table 11). The daily frequency of consuming venison from the Local Area by adults was approximately 10% (i.e., venison sourced from the Local Area was consumed on average once every 9 days) and approximately 88% of all venison consumed by adults was sourced from the Local Area (Table 11). Uncertainty in the adult's venison DCR is discussed in Section 5.2.9.3.

Table 11. Daily Consumption Rates (DCRs) for Venison

Age group	n[a]	Sum of Sampling Weights[b]	Mean (grams/ day)	Minimum (grams/ day)	Maximum (grams/ day)	Percentile[c]		Local Daily Frequency (%)[d]	Percentage Sourced from Local Area (%)[e]
						90th	95th		
Adults[f]	782	3975	12.0	0.0280	270	29	42	10%	88%
Children[g]	134	543	3.8[g]	-	-	9.3[g]	13[g]	9.3%	93%

Note: All ages and both sexes combined.
[a]The number of participants who are consumers: they reported consumption on the FQ or at least one AMPM (U.S. EPA, 2010).
[b]Sum of sampling weights is an approximate estimate of the consumer population.
[c]Estimate of the P90 and P95 of DCR (grams/day) for the members of the CCT population who consume venison.
[d]Values were estimated with the FQ data; the estimate is the mean of the daily frequency of consuming food from the Local Area (i.e., the daily frequency of consumption × the frequency of obtaining the food item from the Local Area).
[e]Values were estimated with the FQ data; the estimate is the mean of the frequency of obtaining the food item from the Local Area.
[f]Estimates by the NCI method for adults (>6 years old). The 24-hour dietary interview data for 0–6-year-olds would not support estimation of venison consumption rates using the NCI method.
[g]Estimates were calculated by multiplying the DCR estimates for adults (by NCI method) to the ratio of the average meal size for children to the average meal size for adults. Meal size estimates did not use sample weights due to the small sample size for children.

Children's DCRs for venison are estimated using the DCR for adults and the ratio of the average meal sizes for children and adults. Meal size estimates did not use sample weights due to the small sample size for children. The average meal size[14] for children, estimated with the 25 venison meals reported by 23 children, was 48 grams with lower and upper 95% confidence limits equal to 35 and 61 grams, respectively. The meal size data for adults was estimated with the 213 meals that were reported by 179 adults. The average meal size for adults was estimated as 151 grams, with 95% confidence limits of 132 and 169 grams, respectively. The ratio of the average meal sizes was 0.32; on average, children's venison meal size was approximately 32% of the adults' venison meal size. Using the NCI model estimates for mean and P95 DCR for adults with the ratio of the child to adult venison meal sizes, the estimates for the children's mean and P95 DCR for venison were 3.8 and 13 grams, respectively. Uncertainty in the children's venison DCR is discussed in Section 5.2.9.3.

5.2.4.2 Wild Upland Birds

The 24-hour recall interviews (AMPMs) did not capture meals that included upland birds; however, approximately 19% of the participants who completed the FQ reported eating wild upland birds.

[14] The actual metric used is the total daily intake. For participants who ate venison more than once during the day that coincided with their 24-hour recall, the total daily intake is the total grams consumed for all meals.

The AMPM captured many reports for chicken and turkey consumption (Table 12), which were evaluated as possible surrogates to estimate meal sizes for wild upland birds. To avoid under-estimating the amount of upland bird meat consumed (on consumption days), the consumption amounts for chicken and turkey presented in Table 12 were estimated using only meals that contained at least 33% of chicken or turkey as an ingredient. The cutoff of 33% was selected based on a review of the food items reported on the AMPMs for different cutoff values.

Table 12. Meal Size Data for Chicken and Turkey

Food Item	Age Group[a]	Daily Consumption (grams/day)						
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95
Chicken	Child	66	54.1	48.9	59.2	99.5	79.6	119
	Adult	389	100	93.0	107	219	184	254
Turkey	Child	31	30.0	23.9	36.2	66.6	46.8	86.4
	Adult	212	60.2	49.0	71.4	206	62.7	350

LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95.
[a]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.

The literature was reviewed to find data on consumption rates for adults for upland birds. Burger and Gochfeld (2002) interviewed 454 people who attended a 3-day sporting event in South Carolina. Participants were shown models of meal sizes to improve the accuracy of their responses. They reported mean meal sizes separately for black (n = 39) and white (n = 415) hunters, as they were interested in testing for possible ethnic differences. Mean meal sizes (± 1 standard error) for dove ranged from 61 (± 17) grams for black hunters to 103 (± 9.0) grams for white hunters; for quail, the mean meal size ranged from 38 (± 20) grams for black hunters to 80 (± 8.9) grams for white hunters; and for wild turkey, the mean meal size ranged from 73 (± 25) grams for black hunters to 127 (± 19) grams for white hunters. Chan et al. (2014) reported an average meal size for 'wild birds' of 183 grams for First Nations communities in Ontario. Wein et al. (1991) reported an average meal size for 'country meats and birds…' of 58 grams for Native Canadians who live near Wood Buffalo Park, based on four 24-hour diet recalls completed by 178 Native Canadians (Indian and Metis).

The FQ provided data for the daily frequency with which upland bird meat was consumed (Table 13). The mean daily frequencies of consuming upland birds sourced from the Local Area for children and adults were 3.26% and 3.18% (approximately 12 days/year), respectively. The P95s for daily frequency of consuming upland birds from the Local Area were approximately 7.52% (27 days/year) and 6.76% (25 days/year) for children and adults, respectively. Close to 100% of wild upland birds were sourced from the Local Area: the estimated mean percentages for children and adults were 100% and 98%, respectively. The estimated number of days that include the consumption of wild upland birds sourced from each of the CCT resource zones is available in Appendix F.

Table 13. Estimated Consumption Frequency for Upland Birds and Waterfowl

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
Upland birds	Child	29	0.0326	0.0227	0.0424	0.0752	0.0482	0.1020	100%
	Adult	186	0.0318	0.0236	0.0399	0.0676	0.0429	0.0923	98%
	All consumers	215	0.0318	0.0245	0.0392	0.0697	0.0481	0.0914	98%
Waterfowl	Child	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	Adult	13	0.0137	0.0099	0.0175	0.0158	0.0110	0.0206	79%
	All consumers	16	0.0142	0.0111	0.0173	0.0158	0.0105	0.0211	82%

LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95.

[a]Estimates are based on upland birds and waterfowl sourced from the Local Area.

[b]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.

The meal sizes reported in the literature for wild upland birds, described above, ranged from 38 to 183 grams. Considering the variability in the meal sizes reported in the literature, the preference was to use data provided by the AMPMs to estimate a site-specific meal size for upland birds. The adults' mean meal size for chicken (Table 12) was used as a surrogate for the mean upland bird meal size and combined with the estimated frequency of consuming upland birds (Table 13) to estimate DCRs for upland birds for adults. The mean adult DCR for upland birds (3.2 grams/day) is the product of the mean meal size for chicken and mean daily frequency for upland birds. The P95 adult DCR for upland birds (6.8 grams/day) is the product of the mean meal size for chicken and P95daily frequency for upland birds. Given the smaller sample sizes available to estimate meal sizes and consumption frequency for children (Tables 12 and 13), the DCRs for children could be estimated as a percentage of the adult DCRs, using a regression model developed by the IOM (2005).

5.2.4.3 Wild Waterfowl

The 24-hour recall interviews (AMPMs) did not capture meals that included waterfowl. The literature was reviewed for data on consumption rates for waterfowl. Burger and Gochfeld (2002) interviewed 454 people who attended a 3-day sporting event in South Carolina (see Section 5.2.4.2). Mean meal sizes (± 1 standard error) for duck ranged from 24 (± 10.7) grams for black hunters to 75 (± 8.3) grams for white hunters. Duchesne et al. (2004) reported an average meal size for waterfowl of 181 grams (95% confidence interval: 173,189 grams), based on a stratified random sample of 512 adult hunters who lived along the St. Lawrence River in Quebec. Wilson (2013) reported meal sizes for ducks for children and adults of 57 and 200 grams, respectively; the meal sizes were approximate meal sizes recommended by representatives of First Nations for an HHRA. Other pertinent data for waterfowl meal sizes are provided by Chan et al. (2014) and Wein et al. (1991), as discussed in Section 5.2.4.2.

The FQ provides data for daily frequency of consuming waterfowl that were sourced from the Local Area and the percentage of waterfowl that were sourced from the Local Area. The FQ provided data for 3 children and 13 adults who reported consuming waterfowl; the average daily frequency for all consumers (adults and children) was approximately 1.4% (5 times per year; Table 13). Consumers reported that approximately 82% of the waterfowl were sourced from the Local Area (Table 13). The

estimated number of days that include the consumption of waterfowl that was sourced from each of the CCT resource zones is available in Appendix F.

Daily consumption rates for waterfowl were estimated using the approach described in Section 5.2.4.2 for upland birds. Similar to the meal sizes reported for wild upland birds, the literature provided a wide range of meal sizes for waterfowl. With a preference for data provided by the AMPMs to estimate site-specific meal sizes, the adults' mean meal size for chicken (Table 12) was also used as a surrogate for the mean waterfowl meal size for adults, which was combined with the estimated frequency of consuming waterfowl (Table 13) to estimate DCRs for adults. The mean adult DCR for waterfowl (1.4 grams/day) is the product of the mean meal size for chicken and mean daily frequency for waterfowl. The P95 adult DCR for waterfowl (1.6 grams/day) is the product of the mean meal size for chicken and P95 daily frequency for waterfowl. The data available from the survey to estimate DCRs for children are very limited; therefore, DCRs for children may be estimated as a percentage of the adult DCRs, using a regression model developed by the IOM (2005).

5.2.5 Livestock

Livestock reported on the FQ included beef, bison, chicken, duck, goat, lamb, pork, and turkey; bison was included in the beef category. Approximately 99% of the participants (n = 1155) who completed the survey reported eating livestock on the AMPM. As discussed in Section 4.3, DCRs for livestock were estimated using "amount-only" models (NCI, 2012; MWL, 2016). Potential covariates that were considered included the eight categories for age and sex that were used in the sample design, and the 2 categories that will be used in the HHRA (children 0–6 years old and adults 7 years old and older). The former provided a lower AIC value and were used as the covariate for the amount-only model estimates. The DCR estimates are presented in Table 14. The estimated mean DCRs for children and adults are 70 and 130 grams/day, respectively; the P95s for children and adults are 120 and 220 grams/day, respectively.

Table 14. DCRs (grams/day) for Livestock Using the NCI Method

Age Group (years)[a]	n[b]	Sum of Sampling Weights[c]	Mean (grams/day)	Minimum (grams/day)	Maximum (grams/day)	Percentile[d]		Local Daily Frequency (%)[e]	Percentage Sourced from Local Area (%)[f]
						90th	95th		
Males									
0–6	81	345	67	15	250	99	110	8%	21%
7–17	97	501	120	32	330	170	190	12%	20%
18–54	190	1264	170	35	500	230	260	10%	20%
55+	153	696	140	29	370	200	220	13%	26%
Females									
0–6	86	329	73	14	200	110	120	7%	16%
7–17	88	428	96	23	280	140	150	5%	12%
18–54	239	1449	120	26	420	180	190	10%	20%
55+	221	950	100	22	300	150	170	8%	18%
17–45[g]	159	953	120	26	410	180	190	10%	19%

Table 14. DCRs (grams/day) for Livestock Using the NCI Method

Age Group (years)[a]	n[b]	Sum of Sampling Weights[c]	Mean (grams/day)	Minimum (grams/day)	Maximum (grams/day)	Percentile[d]		Local Daily Frequency (%)[e]	Percentage Sourced from Local Area (%)[f]
						90th	95th		
Age and Sex Combined									
Adult	988	5288	130	22	500	200	220	10%	20%
Child	167	674	70	15	240	100	120	8%	19%
All	1155	5962	120	15	500	190	210	10%	19%

[a]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.
[b]The number of participants who are consumers: they reported consumption on the FQ or at least one AMPM (U.S. EPA, 2010).
[c]Sum of sampling weights is an approximation of the consumer population.
[d]Estimate of the P90 and P95 of DCR (grams/day) for the CCT population.
[e]Values were estimated with the FQ data; the estimate is the mean of the daily frequency of consuming food from the Local Area (i.e., the daily frequency of consumption × the frequency of obtaining the food item from the Local Area)
[f]Values were estimated with the FQ data; the estimate is the mean of the frequency of obtaining the food item from the Local Area.
[g]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

The FQ provided data for the daily frequency of consumption and source(s) for beef, bison, goat, pork and lamb as a whole; the FQ database does not provide data for the consumption frequency or source(s) for bison separately. The FQ data for livestock were used to estimate the proportion of cultivated livestock that are sourced from the Local Area and the daily frequency of eating livestock sourced from the Local Area. Approximately 20% of the livestock consumed by the population of consumers was from the Local Area; the proportion varied from 12–26% among the age-sex categories presented in Table 14. The frequency of eating livestock sourced from the Local Area is approximately 10% (i.e., once every 10 days) and varied from 5–13% (Table 14). The estimated number of days that include the consumption of livestock sourced from each of the CCT resource zones is available in Appendix F.

5.2.6 Dairy Products and Eggs

The FQ identified dairy as "products such as milk, cream, cheese, yogurt, or ice cream from cows, sheep, or goats" (Westat, 2010). The FQ did not distinguish among the types of dairy products; each participant provided one response for daily frequency and the percentage sourced from the Local Area for dairy products as a whole. The FQ data for dairy were not used as covariates in the NCI model estimates for milk; however, they were used to estimate the proportion of dairy products that are sourced from the Local Area and the daily frequency of consuming dairy products that are sourced from the Local Area. Approximately 4% of the dairy consumed by the population of consumers was sourced from the Local Area; the percentage varied from 1 to 11% among the age-sex categories (Table 15). The frequency of consuming dairy sourced from the Local Area was approximately 4% (i.e., once every 25 days) and varied from 1 to 10% (Table 15). The estimated number of days that include the consumption of dairy sourced from each of the CCT resource zones is available in Appendix F.

Table 15. DCRs (grams/day) for Milk Using the NCI Method

Age Group (years)[a]	n[b]	Sum of Sampling Weights[c]	Mean (grams/ day)	Minimum (grams/ day)	Maximum (grams/ day)	Percentile[d]		Local Daily Frequency (%)[e]	Percentage Sourced from Local Area (%)[f]
						90th	95th		
Males									
0–6	84	384	420	4.7	1900	720	850	10%	11%
7–17	97	501	350	7.7	1900	620	720	1%	1%
18–54	190	1264	260	7.7	1600	460	560	5%	6%
55+	154	704	230	7.0	2000	420	510	4%	4%
Females									
0–6	90	352	330	19	1800	560	660	4%	5%
7–17	88	428	350	19	1600	600	720	5%	5%
18–54	239	1449	200	7.2	1300	370	450	3%	3%
55+	223	955	230	6.9	1800	410	500		3%
17–45[g]	159	953	210	7.1	1500	390	470	2%	2%
Age and Sex Combined									
Adult	991	5301	250	6.9	1800	460	560	4%	4%
Child	174	736	370	17	1900	660	780	7%	8%
All	1165	6037	270	6.9	1900	490	600	4%	4%

[a]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.
[b]The number of participants who are consumers: they reported consumption on the FQ or at least one AMPM (U.S. EPA, 2010).
[c]Sum of sampling weights is an approximate estimate of the consumer population.
[d]Estimate of the P90 and P95 of DCR (grams/day) for the CCT population.
[e]Values were estimated with the FQ data; the estimate is the mean of the daily frequency of consuming food from the Local Area (i.e., the daily frequency of consumption × the frequency of obtaining the food item from the Local Area)
[f]Values were estimated with the FQ data; the estimate is the mean of the frequency of obtaining the food item from the Local Area.
[g]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

All participants (n = 1165) who completed the Tribal Survey reported consuming milk on the AMPM. The DCRs for milk include milk found in creams and cheese products, milk used as an ingredient in food products, and milk added during food preparation. Only cow milk is included in these estimates; milk from humans and goats reported on the AMPMs were not included. DCRs for milk were estimated using "amount-only" models (MWL, 2016; NCI, 2012). Potential covariates that were considered included the eight categories for age and sex that were used in the sample design and the two categories that will be used in the HHRA (children 0–6 years old and adults 7 years old and older); the former provided a lower AIC value and were used as the covariate for the amount-only model estimates. The DCR estimates are presented in Table 15. The estimated mean DCRs for children and adults are 370 and 250 grams/day, respectively; the P95s for children and adults are 780 and 560 grams/day, respectively.

The FQ provided data for the frequency of consuming eggs from domestic poultry. Participants reported eating eggs from one or more of the following types of domestic poultry: chicken, duck, goose, turkey, and Cornish game hens. The FQ did not distinguish among the types of domestic poultry that were used as a food source; e.g., the data do not support estimating the daily frequency of eating chicken eggs sourced from the Local Area. Similarly, the percentage of egg consumption that was sourced from the Local Area includes all types of domestic poultry that were reported on the FQ. The FQ data for eggs were used to estimate the proportion of domestic poultry eggs that were sourced from the Local Area and

the daily frequency of consuming domestic poultry eggs that were sourced from the Local Area. Approximately 13% of the domestic poultry eggs consumed by the population of consumers was sourced from the Local Area; the percentage varied from 9 to 17% among the age-sex categories (Table 16). The frequency of consuming domestic poultry eggs sourced from the Local Area was approximately 7% (i.e., approximately once every 2 weeks) and varied from 4 to 10% (Table 16).

Table 16. Estimated DCRs (grams/day) for Eggs Using the NCI Method

Age Group (years)[a]	n[b]	Sum of Sampling Weights[c]	Mean (grams/ day)	Minimum (grams/ day)	Maximum (grams/ day)	Percentile[d]		Local Daily Frequency (%)[e]	Percentage Sourced from Local Area (%)[f]
						90th	95th		
Males									
0–6	81	345	18	0.59	150	34	43	7.8%	17%
7–17	94	477	21	1.20	160	39	48	4.5%	9.1%
18–54	190	1264	34	1.10	340	62	77	7.8%	15%
55+	154	704	45	0.93	260	80	97	10%	13%
Females									
0–6	84	322	21	0.79	180	40	49	3.8%	15%
7–17	87	423	20	0.18	130	39	48	6.3%	11%
18–54	239	1449	32	0.61	320	58	72	6.0%	9%
55+	222	953	34	1.20	290	62	75	5.7%	14%
17–45[g]	159	953	31	0.6	320	58	71	7.9%	12%
Age and Sex Combined									
Adult	986	5270	33	0.18	300	61	76	6.7%	12%
Child	165	667	19	0.59	160	37	46	5.8%	16%
All	1151	5937	31	0.18	300	59	74	6.7%	13%

[a]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.
[b]The number of participants who are consumers: they reported consumption on the FQ or at least one AMPM (U.S. EPA, 2010).
[c]Sum of sampling weights is an approximation of the consumer population.
[d]Estimate of the P90 and P95 of DCR (grams/day) for the CCT population.
[e]Values were estimated with the FQ data; the estimate is the mean of the daily frequency of consuming food from the Local Area (i.e., the daily frequency of consumption × the frequency of obtaining the food item from the Local Area)
[f]Values were estimated with the FQ data; the estimate is the mean of the frequency of obtaining the food item from the Local Area.
[g]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

Approximately 99% (n = 1151) of the participants who completed the Tribal Survey reported consuming eggs on the AMPM. The AMPM data indicates all eggs reported on the 24-hour recalls were from chickens[15]. DCRs for eggs were estimated using the "correlated" form of the NCI model. Estimates with the amount-only model were not reliable. For example, the means estimated for adults and children by the NCI amount-only models were approximately twice as large as the sample-weighted estimates. This may be due to a bimodal distribution of the daily egg intake totals; however, reasonable estimates appeared to be produced by a correlated model. Regardless, the DCRs for eggs should be considered highly uncertain at this time. Potential covariates that were considered included the eight categories for age and sex that were used in the sample design and the two categories that will be used in the HHRA

[15] There are no USDA food codes in the AMPM data that begin with the digits '312' that are used for 'other poultry eggs'; and there are no modification codes that indicate other types of eggs were used in the preparation of a food item that was reported on the 24-hour recalls.

(children 0–6 years old and adults 7 years old and older); the former provided a slightly lower AIC value and were used as the covariates for the NCI estimates presented in Table 16. The estimated mean DCRs for children and adults are 19 and 33 grams/day, respectively; the P95s for children and adults are 46 and 76 grams/day, respectively.

5.2.7 Cultivated Fruits and Vegetables

This section describes consumption rates for cultivated fruits and vegetables, exclusive of wild plants (terrestrial and aquatic), which are discussed in Section 5.2.8.

All but three of the participants (n = 1162) who completed the Tribal Survey reported consuming either a fruit or vegetable on an AMPM. DCRs for fruits and vegetables were estimated using an amount-only NCI model. The estimated mean DCRs for children and adults were 400 and 510 grams/day, respectively; the P95s were 680 and 850 grams/day, respectively (Table 17).

Table 17. DCRs (grams/day) for Fruits and Vegetables Using the NCI Method

Age Group (years)[a]	n[b]	Sum of Sampling Weights[c]	Mean (grams/ day)	Minimum (grams/ day)	Maximum (grams/ day)	Percentile[d]		Local Daily Frequency (%)[e]	Percentage Sourced from Local Area (%)[f]
						90th	95th		
Males									
0–6	83	374	400	14	1300	620	700	29%	37%
7–17	96	497	490	35	1500	740	820	29%	38%
18–54	190	1264	520	58	1700	770	860	34%	41%
55+	154	704	560	75	1700	830	930	29%	39%
Females									
0–6	89	342	390	45	1400	590	670	32%	37%
7–17	88	428	470	65	1300	710	800	34%	45%
18–54	239	1449	500	72	2000	750	840	36%	42%
55+	223	955	490	59	1800	740	830	34%	43%
17–45[g]	159	953	500	71	1500	750	840	36%	43%
Age and Sex Combined									
Adult	990	6250	510	39	1800	760	850	34%	42%
Child	172	716	400	26	1300	610	680	31%	37%
All	1162	6013	500	29	1800	750	840	33%	41%

Note: The UCR was not identified as a source for fruits and vegetables. The source of approximately 2% of fruits and vegetables consumed was not provided (i.e., location = "999").

[a]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.

[b]The number of participants who are consumers: they reported consumption on the FQ or at least one AMPM (U.S. EPA, 2010).

[c]Sum of sampling weights is an approximation of the consumer population.

[d]Estimate of the P90 and P95 of DCR (grams/day) for the CCT population.

[e]Values were estimated with the FQ data; the estimate is the mean of the daily frequency of consuming food from the Local Area (i.e., the daily frequency of consumption × the frequency of obtaining the food item from the Local Area)

[f]Values were estimated with the FQ data; the estimate is the mean of the frequency of obtaining the food item from the Local Area.

[g]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

The FQ provided data for daily frequency of consumption and sources for the category of fruits and vegetables as a whole; the FQ database does not provide consumption frequency or source(s) of specific vegetables or fruits. While the FQ data were not used as covariates in the NCI model estimates, they were used to estimate the proportion of cultivated fruits and vegetables that are sourced from the Local Area.

Three participants reported not consuming any fruits or vegetables in the prior year. Approximately 41% of the total fruits and vegetables consumed were sourced from the Local Area; the percentage varies between 37 and 45% by age and sex (see Table 17). The daily frequency of sourcing fruits and vegetables from the Local Area is approximately 33% (i.e., once every 3 days) and varies between 29 and 36%. These frequencies are approximate; the percentages for specific fruits and vegetables likely vary across a much wider range of values. The estimated number of days that include the consumption of fruits and vegetables from each of the CCT resource zones is available in Appendix F.

5.2.8 Wild Plants

The FQ was used to identify the types of plants that are included in the wild plant category. Wild plants that were reported on at least one AMPM include: balsamroot, bitterroot, huckleberry, lomatium (white camas), blackberry, wild onion, wild potato, and raspberry. Due to the low frequency of consumption of wild plants available in the AMPM database, population estimates of DCRs are not provided. Table 18 provides the survey data for meal size estimates for wild plants; Table 19 details the estimated frequency of consumption of wild plants based on the FQ (see also Appendix G).

Table 18. Meal Size Estimates (grams) for Wild Plants (Terrestrial and Aquatic)

Food Item	Sex/Age Group (years)[a]	n[b]	Mean[c] (grams)	SE	Minimum (grams)	Maximum (grams)
Balsam root	Female (18–54)	1	180	–	180	180
	Adult	1	180	–	180	180
	Child	–	–	–	–	–
	All Consumers	1	180	–	180	180
Bitter root	Male (7–17)	1	85	–	85	85
	Male (18–54)	1	85	–	85	85
	Female (0–6)	1	170	–	170	170
	Adult	2	85	0	85	85
	Child	1	170	–	170	170
	All Consumers	3	113	28	85	170
Huckleberry	Male (0–6)	3	32	17	1.5	59
	Male (7–17)	1	0.0012	–	0.0012	0.0012
	Male (18–54)	1	145	–	145	145
	Male (55+)	7	23	11	0.0009	78
	Female (0–6)	2	54	44	10	98
	Female (7–17)	2	78	77	1.5	155
	Female (18–54)	11	50	14	0.0004	148
	Female (55+)	9	46	17	0.0012	155

Table 18. Meal Size Estimates (grams) for Wild Plants (Terrestrial and Aquatic)

Food Item	Sex/Age Group (years)[a]	n[b]	Mean[c] (grams)	SE	Minimum (grams)	Maximum (grams)
	Adult	31	46	9.2	0.0004	155
	Child	5	41	18	2	98
	All Consumers	36	45	8.2	0.0004	155
Lomatium	Male (18–54)	1	15	–	15	15
	Female (7–17)	1	78	–	78	78
	Female (18–54)	1	78	–	78	78
	Female (55+)	1	60	–	60	60
	Adult	4	58	15	15	78
	Child	–	–	–	–	–
	All Consumers	4	58	15	15	78
Blackberry	Female (55+)	1	13	–	13	13
	Adult	1	13	–	13	13
	Child	–	–	–	–	–
	All Consumers	1	13	–	13	13
Wild onion	Female (0–6)	1	54	–	54	54
	Adult	–	–	–	–	–
	Child	1	54	–	54	54
	All Consumers	1	54	–	54	54
Wild potato	Female (0–6)	1	85	–	85	85
	Adult	–	–	–	–	–
	Child	1	85	–	85	85
	All Consumers	1	85	–	85	85
Raspberry	Female (18–54)	1	554	–	554	554
	Female (55+)	2	55	53	1.9	108
	Adult	3	221	169	2	554
	Child	–	–	–	–	–
	All Consumers	3	221	169	2	554

Note: The estimates/data shown above describe total daily consumption amounts (the same as meal sizes if the food item was only consumed once per day). The values shown above are not population estimates of DCRs. These data included only 24-hour recalls that reported consumption of the food item.

[a]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.

[b]The number of participants who reported consumption on at least one AMPM (U.S. EPA, 2010).

[c]Due to the number of participants who reported consumption of wild plants, sampling weights were not used to estimate statistics.

Table 19. Estimated Consumption Frequency for Wild Plants (Terrestrial and Aquatic) with Data Provided by the Food Questionnaire

		Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
Food Item[a]	Age Group[b]	n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
Balsamroot	Adult	95	0.0620	0.0145	0.1095	0.2357	–	–	97%
	Child	14	0.0585	0.0	0.1177	0.1709	–	–	100%
	All consumers	109	0.0617	0.0182	0.1052	0.2328	–	–	97%

Table 19. Estimated Consumption Frequency for Wild Plants (Terrestrial and Aquatic) with Data Provided by the Food Questionnaire

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
Bearberry	Adult	1	0.0167	0.0167	0.0167	0.0167	–	–	100%
	Child	0	–	–	–	–	–	–	–
	All consumers	1	0.0167	0.0167	0.0167	0.0167	–	–	100%
Bitterroot	Adult	176	0.0294	0.0225	0.0363	0.0623	0.0395	0.0851	80%
	Child	26	0.0182	0.0159	0.0204	0.0238	–	–	86%
	All consumers	202	0.0281	0.0220	0.0342	0.0553	0.0329	0.0778	81%
Blackberry	Adult	148	0.0427	0.0283	0.0572	0.1107	0.0	0.2268	74%
	Child	18	0.0307	0.0206	0.0408	0.0744	–	–	96%
	All consumers	166	0.0414	0.0285	0.0543	0.1067	0.0452	0.1682	76%
Camas[c]	Adult	152	0.0392	0.0255	0.0528	0.0718	0.0223	0.1213	76%
	Child	30	0.0213	0.0172	0.0254	0.0339	.	.	91%
	All consumers	182	0.0368	0.0250	0.0486	0.0665	0.0332	0.0998	78%
Chokecherry	Adult	135	0.0398	0.0256	0.0541	0.0811	0.0010	0.1612	87%
	Child	13	0.0292	0.0185	0.0399	0.0363	–	–	91%
	All consumers	148	0.0389	0.0259	0.0520	0.0817	0.0256	0.1378	88%
Hazelnut	Adult	34	0.0270	0.0176	0.0365	0.0675	–	–	34%
	Child	1	0.0167	0.0167	0.0167	0.0167	–	–	49%
	All consumers	35	0.0267	0.0175	0.0358	0.0668	–	–	35%
Huckleberry	Adult	657	0.0417	0.0355	0.0480	0.1429	0.1111	0.1746	83%
	Child	113	0.0430	0.0307	0.0554	0.1075	0.0489	0.1661	88%
	All consumers	770	0.0419	0.0362	0.0476	0.1429	0.1111	0.1746	84%
Lomatiums[d]	Adult	113	0.0380	0.0224	0.0536	0.0709	0.0167	0.1251	84%
	Child	12	0.0207	0.0166	0.0248	0.0299	–	–	100%
	All consumers	125	0.0363	0.0223	0.0504	0.0670	0.0134	0.1206	86%
Mint	Adult	2	0.0251	0.0155	0.0348	0.0317	–	–	100%
	Child	1	0.0167	0.0167	0.0167	0.0167	–	–	100%
	All consumers	3	0.0219	0.0147	0.0291	0.0306	–	–	100%
Parsley	Adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	Child	0	–	–	–	–	–	–	–
	All consumers	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Pine nut	Adult	27	0.0420	0.0161	0.0680	0.1088	0.0	0.3716	36%
	Child	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	39%
	All consumers	29	0.0405	0.0162	0.0648	0.1044	0.0	0.3612	36%
Pine pitch	Adult	1	0.0833	0.0833	0.0833	0.0833	.	.	100%
	Child	0	-	-	-	-	-	-	-
	All consumers	1	0.0833	0.0833	0.0833	0.0833	.	.	100%
Raspberry	Adult	209	0.0267	0.0215	0.0319	0.0398	0.0092	0.0704	91%
	Child	38	0.0253	0.0190	0.0317	0.0586	–	–	92%
	All consumers	247	0.0265	0.0219	0.0311	0.0448	0.0213	0.0684	91%
Sarvisberry	Adult	154	0.0425	0.0245	0.0604	0.0680	0.0206	0.1155	89%
	Child	13	0.0322	0.0181	0.0462	0.0705	–	–	83%

Table 19. Estimated Consumption Frequency for Wild Plants (Terrestrial and Aquatic) with Data Provided by the Food Questionnaire

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
	All consumers	167	0.0418	0.0250	0.0586	0.0686	0.0422	0.0951	89%
Spring beauty	Adult	119	0.0319	0.0181	0.0457	0.0330	0.0223	0.0438	83%
	Child	10	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	89%
	All consumers	129	0.0308	0.0180	0.0435	0.0317	0.0210	0.0423	84%
Wild mint	Adult	2	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	100%
	Child	0	–	–	–	–	–	–	–
	All consumers	2	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	100%
Wild onion	Adult	1	0.0167	0.0167	0.0167	0.0167	–	–	100%
	Child	0	–	–	–	–	–	–	–
	All consumers	1	0.0167	0.0167	0.0167	0.0167	–	–	100%
Wild rose	Adult	90	0.0620	0.0356	0.0885	0.1763	0.0	0.3951	86%
	Child	9	0.0293	0.0130	0.0456	0.0684	–	–	100%
	All consumers	99	0.0596	0.0351	0.0840	0.1438	0.0	0.3623	87%

LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95.
[a]Estimates are based on wild plants sourced from the Local Area.
[b]Adults are defined as 7 years and older; children are defined as being 0–6 years of age.
[c]The source of this data is question 51 in the food questionnaire.
[d]The source of this data is question 45d in the food questionnaire.

5.2.9 Sources of Uncertainty in Dietary Estimates

The 24-hour dietary recalls provided detailed records of food items consumed during the recall periods, but 24-hour recalls tend to under-estimate the frequency for foods that are consumed infrequently and over-estimate the variability in daily consumption rates within a population (Dodd et al., 2006). The FQ was developed specifically for the Tribal Survey, based on a validated food frequency questionnaire that had been used in many large surveys (Westat, 2010). A draft version of the FQ was also tested with members of the survey population. An advantage of FQs in general is they are more likely to capture food items that are consumed infrequently, while a disadvantage is that participants tend to have difficulty accurately recalling the frequency of eating particular food items (Dodd et al., 2006).

As discussed in Section 5.2, the FQ data were not used as covariates in any of the NCI models to estimate DCRs; however, the responses to the first question about each food item (e.g., "In the past 12 months did you eat fish or seafood at all?") were used together with the AMPM data to define the subpopulation of consumers. The FQ data were used to estimate the proportion of food sourced from the Local Area. As discussed in Section 4.2, the FQ data were reviewed to identify responses that were incorrectly coded as "-1" (appropriate skips) or "-3" (inappropriate skips). If coded correctly, the "-3" responses constitute missing values (a type of non-response). Responses coded as "-1" in the database were not relevant and not used to estimate the proportion of food sourced from the Local Area. For example, if a participant reported not consuming fish on the FQ, they would be assigned to the domain for the subpopulation who did not report consuming fish and their responses regarding frequency and source of fish (which are appropriate skips and should = "-1") were not relevant. Sources of uncertainty with dietary estimates of major food items are discussed below.

5.2.9.1 Fish

Estimation of long-term DCR required differentiation of two sources of variability in the amount of fish consumed: (1) the variability in the amount consumed by different members of the population (between-person variance) and (2) the variability in the amount of fish consumed by the same person on the days the person eats fish (within-person variance). Ideally, the population estimate of the distribution of daily fish consumption reflects only the former (i.e., between-person variance). A key parameter of the NCI model was used to account for the within-person variance in fish consumption, and this parameter was estimated using data provided by participants who reported consuming fish on more than one AMPM. The freshwater finfish data included just 12 participants who reported fish consumption on more than one AMPM. Consequently, the within-person variance in fish consumption was assumed to be the same for all CCT fish consumers, regardless of age or sex. The limited number of participants who reported fish consumption on more than one AMPM raise some questions about the reliability of the fish DCR estimates.

As a partial evaluation of the potential bias in the estimates, a simulation study was performed using the NCI model and a dataset that included all food items containing fish at more than 1% by weight, including freshwater finfish, saltwater finfish, and shellfish (MWL, 2016; Appendix C). This "total fish" dataset includes 45 participants who reported fish consumption on more than one AMPM. The simulation study generated 1000 datasets that each included approximately 12 participants who reported fish consumption on more than one AMPM. For each of the 1000 datasets, the NCI model was used to estimate the mean and percentiles of the distribution of fish DCR. The estimates of the mean, P90, and P95 for each of the 1000 datasets were compared to the estimates that were generated with the complete "total fish" dataset. The results showed that the estimates for the 1000 datasets differed by less than 10% of the width of the 95% confidence interval. Appendix C provides details for the simulation study approach and results.

Confidence intervals were also developed for the NCI model estimates using a parametric bootstrapping approach and 1000 simulated datasets. The bootstrapped confidence intervals were determined using the freshwater finfish dataset (not the 'total fish' dataset). The 95% confidence intervals for each parameter (mean, P90, and P95) correspond to the 2.5^{th} and 97.5^{th} percentiles of the 1000 estimates for the parameters. Appendix C provides details for the bootstrapping approach and results.

5.2.9.2 Shellfish

The FQ data for mussels sourced from the Local Area was provided by 10 participants (Table 9). An additional 61 participants provided data on the FQ for mussels were not sourced from the Local Area (Table 9); including these participants' responses, the average daily frequency of consumption was approximately 2.4% (approximately 8.8 days per year). The estimates for the frequency of consuming crayfish sourced from the Local Area are based on a much larger number of participants (n = 80; Table 9). The 24-hour recalls did not capture consumption of locally-sourced shellfish. The AMPM data includes meal size information for commercial sources of shellfish (Table 9) that may be useful to

estimate DCRs of locally-sourced mussels and crayfish if they are needed for the HHRA. The literature is another potential source of information for shellfish consumption.

5.2.9.3 Venison

The number of participants who reported venison consumption on more than one AMPM (n = 30 participants, Table 3) prevented reliable estimation of venison DCRs by age. Furthermore, only two children (0–6 years old) reported consuming venison on more than one AMPM, which prevented estimating venison DCRs for children with the NCI method. The NCI method was used to estimate the venison DCR for survey participants >6 years old (i.e., the HHRA adult group). The DCR for venison for children 0–6 years old was estimated using the adults' NCI model estimates and the ratio of children's average venison meal size to the adult's average meal size. Sources of uncertainty in the FQ data, the NCI model estimate, and the children's DCR estimates are described below.

The venison consumption data for adults (n = 782 participants; Table 11) included 9 participants (24 AMPMs) with positive consumption on at least 1 AMPM and missing values on the FQ for daily frequency. The NCI data file includes zeroes for daily frequency for three participants (eight AMPMs) who indicated they ate venison but provided responses of "never?" or "don't know" for daily frequency, which were converted to zeroes (Table 2). The three zero values for daily frequency are valid zero responses (MWL, 2016) and were retained in the NCI data file as zeroes.

The 9 participants with missing values correspond to participants who responded that they did not eat venison in the preceding 12 months; therefore, all subsequent questions regarding venison consumption were appropriately skipped (the database has responses equal to "-1" for the subsequent responses). Daily frequencies were imputed for the 9 participants with missing values for daily frequency. To evaluate the potential sensitivity of the imputed values on the NCI estimates, two approaches were used: (1) missing values were replaced with zeroes for daily frequency, and (2) the mean daily frequency for the participants' age-sex category was imputed for the missing daily frequencies. NCI models were estimated using four alternatives for the FQ data; the alternatives corresponded to the combination of the two values that were imputed for missing values (zero or the mean daily frequency) and the form of the FQ data (original scale and natural logarithm of the data). In addition, the effect of estimating models that considered correlation of the between-person variance terms for the probability and amount parts of the NCI model was also evaluated.

The NCI method produced similar estimates for the distribution of DCR for venison for the alternative combinations of the FQ data and model types (correlated/not correlated variance terms) for most models (Table D-1). The models that did not include the FQ data (Models E and F, Table D-1) produced estimates of the between-person variance term for the amount part of the NCI model that are extremely small and not consistent with the models that were estimated with the FQ data as a covariate; therefore, Models E and F were considered unreliable. Using the AIC to compare the remaining models (Models A–D), Model D was preferred. Based on the comparison of the estimates for the distribution of DCR for Models A–D, the missing values for the FQ were not considered an important source of uncertainty in the NCI model.

The data for one participant who reported eating deer, elk, and moose are incomplete. The database should include information for each of the three food items for this participant; however, the

frequency for eating venison equals "-3" while another record, with the type of animal containing a missing value, has a positive value for daily frequency. The actual questionnaires would have to be reviewed to attempt to correct such errors (e.g., match the missing animal type information to the missing frequency information). It is also possible that a review of the actual survey questionnaires would not provide an unequivocal interpretation of the responses.

In addition to including the FQ data as covariates in the NCI model that was used to estimate DCR for venison, the responses to the first question about each food item (e.g., "In the past 12 months did you eat deer at all?") were also used, together with the AMPM data, to define the subpopulation of consumers. The FQ data were also used to estimate the proportion of food sourced from the Local Area and the daily frequency of sourcing venison from the Local Area (Table 11).

The largest venison meal size in the AMPM dataset that was reported by an adult (1308 grams) was identified as a potential outlier. The final NCI model was used to evaluate the effect of the potential outlier on the venison DCR estimates. As discussed in Section 4.3.4, the potential effect of the outlier on the NCI estimate was evaluated using two alternate sampling weights for the potential outlier: 1.0 and the median of the sampling weights. Substituting 1.0 for the sampling weight for the potential outlier produced estimates of 12 and 42 grams/day for the mean and P95 venison DCR, respectively. The same estimates using the median of the sampling weights were 12 and 43 grams/day for the mean and P95 venison DCR, respectively. The effect of potential outliers on the venison DCR was negligible.

A check for extreme sampling weights found the sampling weights for 10 participants (27 records) exceeded the median plus 6 interquartile ranges. After trimming the sampling weights for the 10 participants (i.e., replacing their sampling weights with the median plus 6 interquartile range), the mean and P95 venison DCR were 12 and 42 grams/day, respectively. The effect of potential extreme sampling weights on the venison DCR was negligible.

Sources of uncertainty in the child to adult meal size ratio (0.32) include the amount of data available from the AMPMs and the assumption that meal size ratio is adequate to estimate a ratio for child to adult DCRs. The average venison meal size for children (48 grams) was estimated using 25 meals. The meal size data ranged from 1.5 to 128 grams, the coefficient of variation for the meal size data was 0.8, and the lower and upper 95% confidence limits were 35 and 61 grams, respectively. Considering the range in the child meal size data, the 95% confidence limit for the meal size is not considered large. The average meal size for adults (151 grams) was estimated with 213 meals that ranged in size from 8.8 to 1308 grams. The mean meal size after omitting the one potential outlier (1308 grams) was 145 grams. The coefficient of variation for the meal size data was 1.1 and the lower and upper 95% confidence limits were 132 and 169 grams, respectively. Based on the results of the F-test for equal variance ($p < 0.0001$), 95% confidence limits (LCL = 0.23, UCL = 0.42) for the ratio of the child to adult mean meal size were estimated using a method that assumes normality but does not assume equal variances (Dilba et al., 2006 and Tamhane and Logan, 2004 as implemented in SAS TTEST procedure [SAS, 2017]). The sensitivity of the confidence interval for the ratio to the normality assumption was evaluated under the assumption the data were lognormally distributed. The constant variance assumption for the log-transformed data was not rejected (folded F-test p-value = 0.14). The 95% lower and upper confidence limits for the geometric mean ratio (0.30) were estimated as 0.22 and 0.42, respectively, using Fieller's method (Fieller, 1954), as implemented in the SAS TTEST procedure (SAS, 2017).

Another source of uncertainty in using the ratio of child to adult meal sizes to estimate the DCR for children is the assumption that the daily frequency of venison consumption is similar for children and adults[16]. This assumption was evaluated using the AMPM data and the FQ data. Children reported eating venison on approximately 7.6% of their AMPMs (25/330) while adults reported venison consumption on approximately 11% of their AMPMs (213/2015). Based on the FQ data, the daily frequency of venison consumption for children was 10%, while for adults, it was 13%. Based on the frequency of consumption, using the ratio of the average meal size for children to the average meal size for adults to estimate the DCR for children may tend to bias the DCR for children high by approximately 30%[17].

5.2.9.4 Upland Birds

The 24-hour recalls did not capture consumption of wild upland birds. DCRs were estimated using meal size data provided by the AMPMs for chicken. There is some uncertainty related to using the average domestic poultry meal size as a surrogate for the average meal size for wild upland birds. Burger and Gochfeld (2002) reported both meal sizes and DCRs for market chicken exceed the meal sizes and DCRs for wild game (including dove, duck, quail, and wild turkey). However, the average meal size for adults reported on the AMPM (100 grams) was approximately half the average chicken meal size (ranged from 245 grams for white hunters to 255 grams for black hunters). Furthermore, the average meal size of 100 grams based on the AMPM data is within the range of meal sizes reported in the literature for wild game (38–183 grams; Section 5.2.4.2). This indicates that using the daily meal size of chicken reported on the AMPMs is a reasonable surrogate for estimating meal size for upland birds.

The FQ data include a few participants whose responses may be considered statistical outliers. Three participants (all adults) reported eating wild upland game birds much more frequently than the rest of the participants. They also reported sourcing all the game birds from the Local Area. Two of the participants reported daily frequencies equivalent to approximately 4 days per week (daily frequency = 0.5704) and one participant reported eating wild upland bird meat every day. The next highest daily frequency (0.1429, or approximately once per week) was reported by four participants. Most participants who reported eating wild upland birds (n = 208) reported eating them approximately 6 times per year (daily frequency = 0.0167). The effect of the potential outliers on the estimates is small. The estimates of the mean and P95 decrease by approximately 3 days per year with the three largest responses omitted from the dataset.

5.2.9.5 Waterfowl

The 24-hour recalls did not capture the consumption of wild waterfowl. Using the mean chicken meal size for adults as a surrogate for the mean wild waterfowl meal size for adults is a source of uncertainty in the DCRs for waterfowl presented in Section 5.2.4.3. An alternative to using the average meal size for market chicken that is based on the Tribal Survey AMPM data is to base an estimate on the literature. As is the case for the wild upland bird meal size, the mean of the chicken meal size for meals

[16] The DCR considers how often a food item is consumed and how much of the food item is consumed (i.e., meal size) on days it is consumed.

[17] The 30% figure is based on the ratio of children to adult venison consumption frequency. Based on AMPM, the ratio is approximately 0.7 (7.6%/11%); based on the FQ, the ratio is approximately 0.8 (10%/13%).

reported on the Tribal Survey 24-hour recalls is close to the middle of the wide range of values reported in the literature for waterfowl (24–200 grams).

The FQ data for waterfowl sourced from the Local Area was provided by 16 participants. An additional 7 adults provided data on the FQ for waterfowl that were not sourced from the Local Area; including these participants' responses, the average daily frequency of consumption was approximately 1.9% (approximately 6.8 days per year). The small sample size available from the FQ for waterfowl consumption frequency is a source of substantial uncertainty.

5.2.9.6 Livestock

Seventy-seven participants who completed the FQ reported not eating any livestock in the 12 months prior to completing the FQ. All 77 had appropriate responses for subsequent questions about livestock consumption (e.g., daily frequency), which indicates no participants were omitted from the estimates who may have provided useful data. The database has missing values ("-3") for daily frequency of consumption for two participants who reported consuming livestock; one of these participants reported sourcing most of the livestock from the Local Area while the other reported sourcing all of the livestock from the Local Area. The missing values are not a major source of uncertainty in the estimates of the proportion of livestock sourced from the Local Area as these two participants represent approximately less than 0.2% of the 1155 livestock consumers.

Twenty-one potential outliers were identified in the livestock AMPM dataset. The final NCI model was used to evaluate the effect of the potential outliers on the livestock DCR estimates. The NCI estimates were not sensitive to the potential outliers. Substituting 1.0 for the sampling weights for potential outliers produced estimates that were within 4% of the estimates produced with the original sampling weights. The effect of potential outliers on the livestock DCRs is negligible. Sixteen participants had sampling weights that exceeded the median plus six interquartile ranges. The estimates of the mean and P95 of the DCR were within 1 and 3 grams per day, respectively, of the estimates produced with the original sampling weight. The effect of potential extreme sampling weights on the livestock DCR was negligible.

5.2.9.7 Dairy and Egg Products

Seventy-three participants reported not consuming any dairy in the prior year. The responses for all subsequent questions on daily frequency and source(s) for these 73 people contained appropriate skip values ("-1"), which indicates no participants were removed from the data who could have been included (via imputation for missing values, if necessary). One participant who indicated he/she had consumed dairy in the prior year had an inappropriate skip for daily frequency ("-3") and the percentage of dairy sourced from the Local Area. These responses were treated as missing values in the calculation of the daily frequency of consuming dairy from the Local Area and the proportion of dairy sourced from the Local Area field (Tables 15 and 16). The database includes daily frequencies equal to zero for four participants who indicated that they had consumed dairy in the prior year but provided a response to daily frequency equal to "never?" or "don't know" (Table 2). The database includes a missing value (response equal to "-3;" an inappropriate skip) for the percentage sourced from the Local Area for one

participant who reported consuming dairy every day; this response was omitted from the calculation of the percentage from the Local Area field in Tables 15 and 16.

Three potential outliers were identified in the milk AMPM dataset. The NCI estimates were not sensitive to the potential outliers. Substituting 1.0 for the sampling weights for potential outliers produced estimates of the mean and P95 DCRs that were within 1 gram/day of the estimates produced with the original sampling weights. The sampling weights for 16 participants exceeded the median sampling weight by 6 interquartile ranges. To evaluate the sensitivity of the DCR estimates to the large sampling weights, the DCRs were estimated after the 16 weights were replaced with the median of the sampling weights. The mean and P95 DCRs for children and adults changed by less than 1%.

The estimated DCRs for eggs should be considered highly uncertain at this time due to the apparent bimodal distribution in egg meal size. The data should be further evaluated to determine if the foods containing eggs should be divided into two or more categories prior to estimating DCRs.

5.2.9.8 Cultivated Fruits and Vegetables

All but 3 participants reported consumption of a cultivated fruit or vegetable in the 12 months prior to completing the FQ. Three participants reported positive daily consumption frequency for fruits or vegetables but the database contains missing values ("-3") for subsequent questions regarding which fruits and vegetables had been consumed during the previous 12 months; however, this had no effect on the usability of their responses for daily frequency or the source(s) of fruits and vegetables for these participants.

Twenty-one potential outliers were identified in the cultivated fruit and vegetables AMPM dataset; 13 were identified as potential outliers for being much less than the majority of the meal sizes, while 8 were identified as being much greater than most of the daily totals. The NCI estimates were not sensitive to the potential outliers. Substituting 1.0 for the sampling weights for potential outliers produced estimates of the mean and P95 DCRs that were within 1% of the estimates produced with the original sampling weights. The sampling weights for 15 participants exceeded the median sampling weight by 6 interquartile ranges. The NCI estimates were not sensitive to the extreme sampling weights. Trimming the extreme weights at the median plus six interquartile ranges changed the estimated means and P95s by less than 1%.

Based on their USDA food codes, sugars were included in the cultivated fruits and vegetables category (Section 4.3.2). To evaluate the potential effect of including sugars in the cultivated fruits and vegetables, DCRs for this category were also estimated without including the food codes for sugars. The mean DCR for the population of consumers without sugars was approximately 480 grams/day, which was approximately 3% less than the DCR estimated with sugars included (495 grams/day).

5.3 Non-Dietary Exposure

The ReUP provided data on non-food exposure pathways to UCR-derived media for a range of activities, including medicinal use, tribal ceremonies, food preparation, activities, and production of clothing or household items. These data were used to generate tables of summary statistics that provide the following information:

- Types of media from the Local Area to which respondents are exposed;
- Nature of the exposure pathway(s) to each medium (i.e., oral, dermal, inhalation);
- Number and percentage of individuals exposed, stratified by age, sex, and location of residence;
- Frequency and duration of exposures; and
- Locations in the Local Area where the media were gathered.

As described in Section 4.4, the data from the ReUP were used to estimate exposure parameters for non-dietary exposure pathways. The EF data consist of recalls of the number of days each participant engaged in a particular activity or tribal practice in the 12 months preceding the ReUP interview. The ET data consist of the hours per day that a participant engaged in an activity or practice, on days they engaged in the activity or practice. Estimates are presented in this report by activity/practice, age category, and sex. The activities and practices are briefly defined in Sections 3.2.3 and 4.4; more detailed descriptions are provided in U.S. EPA (2010) and Westat (2012a). The results from statistical comparisons of EF and ET among age groups and between sexes are reported; however, the results should be considered preliminary at this time.

5.3.1 Activities

This section provides an overview of the time spent engaging in non-dietary practices and the location (river reach or CCT resource zone) where these activities occur. The ReUP collected ET (hours/day) and EF (days/year) data on activities associated with surface water (e.g., swimming and gathering plants) and soil/sediment (e.g., hiking, hunting, camping) performed within the previous 12 months, as well as the locations (i.e., river reaches and other CCT resource zones) where the participants engaged in the activities. To estimate contact with surface water and soil/sediment located within each of the CCT resource zones, these data were combined into hours/year (i.e., ET * EF) for each participant. The contact time (hours/year) for each type of activity (in-water, on-water, and on-land) was assumed to occur equally among the CCT resource zones the participant reported (i.e., the contact time per resource zone was calculated by dividing the product of ET*EF for each season by the number of resource zones the participant reported on the questionnaire for that activity and season). The total contact time per resource zone for each participant was calculated as the total of the contact times for each season. The total contact times for each participant were used to estimate the annual hours reported in Tables 20, 21, 24 and 27. The location and estimated annual hours (hours/person/year) are provided in Table 20.

Table 20. Summary of Annual Hours Spent Engaging in Activities in/on Water and on Land

	In Water	On Water	On Land
River Reach	Annual Hours (hours/person/year)[a]	Annual Hours (hours/person/year)[a]	Annual Hours (hours/person/year)[a]
1	14	–	252[b]
2	42	–	252[b]
3	94	108	–
4A	65	80	119[b]

Table 20. Summary of Annual Hours Spent Engaging in Activities in/on Water and on Land

River Reach	In Water	On Water	On Land
	Annual Hours (hours/person/year)[a]	**Annual Hours (hours/person/year)[a]**	**Annual Hours (hours/person/year)[a]**
4B	59	110	138[b]
5	56	56	37[b]
6	61	65	78[b]
888[c]	33	190	43
999[c]	121	153	265
Local Area[d]	134	170	355
UCR[e]	67	104	156[b]

[a]Estimated total hours calculated by dividing the total estimated hours by the estimated population size.
[b]When participants provided a river reach as the location for on-land activities, it was assumed the participants referred to activities engaged in on the river bank.
[c]Zone 888 was assigned when the code recorded by the interviewer did not match an actual resource zone. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location.
[d]Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).
[e]Includes UCR River Reaches R1–R6.

5.3.1.1 Activities in Surface Water

Approximately 3,113 CCT residents engaged in activities in waters located within the Local Area. They spent an estimated 134 hours/person/year engaging in activities in Local Area waters (see Tables 20–23). Approximately 67 hours/person/year, 15% of the total hours, were spent engaging in activities in waters of the UCR. Within the UCR, most of the time was spent in Reaches 4B and 6 (approximately 17,400 and 38,300 hours, respectively; Table 21). The largest number of total hours per year within the Local Area was estimated for Zone 231 (approximately 61,300 hours) and Reach 6 (approximately 38,300 hours). Based on total hours, the largest contact rates were estimated for the southern and western regions of the Local Area, although the CCT also reported engaging in activities in some northern zones of the Local Area (Figure 3). Estimates of the total annual hours and annual hours by CCT resource zone are presented in Table 21 and Figure 3.

EFs (days/year) and ETs (hours/day) by age and sex for activities in Local Area waters are presented in Tables 22 and 23, respectively. The mean EF generally decreases with increasing age ($p = 0.01$),[18] although the variability in EF increases with age; consequently, the P95 of EF is above 90 days/year for all age categories. The mean EFs do not vary consistently between males and females ($p = 0.71$). There also appears to be substantial variability in the mean ETs among the age groups, although it may not be statistically significant ($p = 0.06$); again, the differences between male and female ET do not appear to be statistically significant ($p = 0.14$).

[18] Test results are reported as the probability of observing a larger value of the Wald F-statistic.

Table 21. Estimated Time (hours/person/year) Spent Engaging in Activities in Water

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
100	20	615	31
110	167	16495	99
120	54	4254	78
130	26	2506	96
140	7.0	56	8.0
150	35	1350	39
160	19	1411	76
170	136	19063	141
180	145	15826	109
190	3.1	40	13
200	6.7	73	11
211	8.0	254	32
221	28	1248	44
222	15	373	25
223	78	9098	117
231	698	61281	88
232	46	6732	145
233	8.8	255	29
241	3.3	347	105
242	19	117	6.2
250	31	470	15
261	2.7	57	21
262	4.5	66	15
263	18	1549	84
271	7.6	624	83
272	6.8	75	11
281	28	1407	51
282	87	3779	43
291	265	22643	85
292	2.7	7.1	2.7
300	353	17179	49
311	427	26055	61
312	30	1116	37
320	107	4341	41
330	8.3	396	48
342	1.8	9.2	5.1
343	1.8	9.2	5.1
361	5.0	380	76
363	1.8	33	18
371	4.9	225	46
372	1.3	3.5	2.7
373	33	841	26
374	26	202	7.6

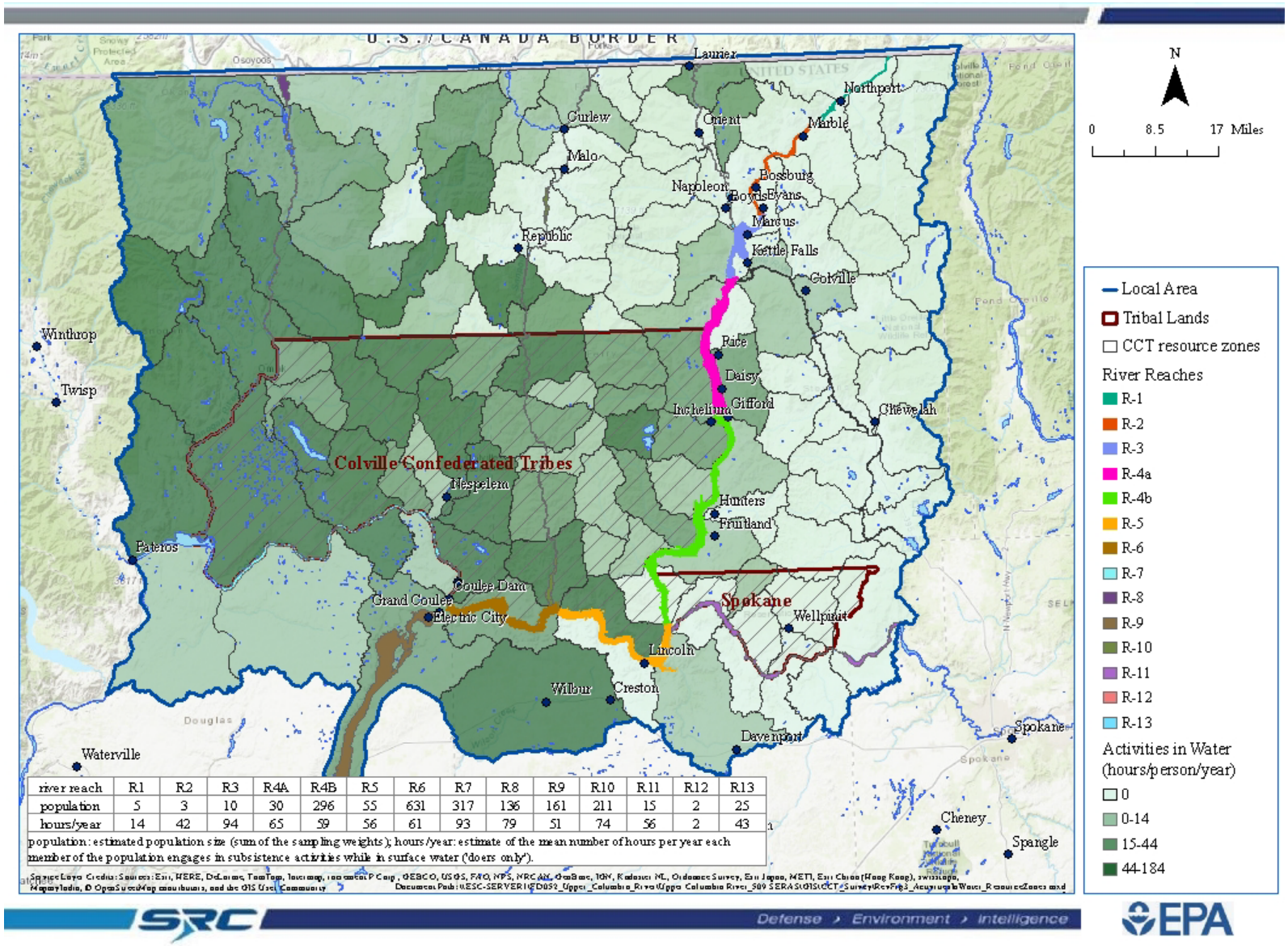
Table 21. Estimated Time (hours/person/year) Spent Engaging in Activities in Water

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
381	23	422	18
382	137	25107	183
392	5.0	96	19
413	3.3	12	3.7
414	1.8	9.2	5.1
421	21	688	33
422	95	2158	23
423	10	186	18
431	529	25037	47
432	102	2704	27
441	42	1022	25
442	20	246	13
451	3.8	7.2	1.9
452	3.9	10	2.5
453	6.2	25	4.0
461	2.1	107	51
481	2.7	115	42
512	1.8	9.2	5.1
521	2.0	46	23
531	1.8	9.2	5.1
541	1.8	9.2	5.1
552	2.3	17	7.3
611	2.1	1.4	0.7
888	24	779	33
999	71	8585	121
R1	4.8	68	14
R2	2.7	115	42
R3	10	915	94
R4A	30	1990	65
R4B	296	17364	59
R5	55	3104	56
R6	631	38250	61
R7	317	29310	93
R8	136	10758	79
R9	161	8243	51
R10	211	15556	74
R11	15	814	56
R12	2.0	4.8	2.4
R13	25	1066	43

Table 21. Estimated Time (hours/person/year) Spent Engaging in Activities in Water

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
Local Area[e]	**3113**	**417824[f]**	**134**
UCR[g]	**925**	**61806[h]**	**67**
% In UCR	**30%**	**15%[i]**	**–**

[a]Zone 888 was assigned when the code recorded by the interviewer did not match an actual resource zone. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location. Shading indicates river reaches that are located within the UCR. Only zones that participants included in their responses are included.
[b]Estimated number of people who engaged in activities. The totals for the Local Area and UCR represent the number of visits rather than the number of unique visitors.
[c]Estimated total hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[d]Estimated total hours by dividing the total estimated hours by the population size.
[e]Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).
[f]Total estimated hours spent engaging in activities within the Local Area; sum of the total hours estimated for each zone.
[g]Includes UCR River Reaches R1–R6.
[h]Total estimated hours spent engaging in activities within the UCR; sum of the total hours estimated for UCR River Reaches R1–R6.
[i]Percent of total annual hours spent engaging in activities in water within the UCR; estimated by dividing the total annual hours for UCR by the total annual hours for the Local Area.



river reach	R1	R2	R3	R4A	R4B	R5	R6	R7	R8	R9	R10	R11	R12	R13
population	5	3	10	30	296	55	631	317	136	161	211	15	2	25
hours/year	14	42	94	65	59	56	61	93	79	51	74	56	2	43

population: estimated population size (sum of the sampling weights); hours/year: estimate of the mean number of hours per year each member of the population engages in subsistence activities while in surface water ('doers only').

Figure 3. Activities in water by CCT resource zone.

Table 22. Estimated Frequency (days/year) Spent Engaging in Activities in Water

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL 95	UCL 95	SD	CV	Min	Percentile			LTL 95	UTL 95	Max	Freq (%)[b]
									P50	P90	P95				
Males															
14–17	29	158	39	29	49	77	2.0	4	42	80	110	–	–	150	93
18–54	147	1013	37	31	42	82	2.3	4	27	76	91	75	120	240	80
55+	61	286	27	20	34	77	2.8	4	16	58	92	52	160	200	41
Females															
14–17	29	162	50	40	61	72	1.4	4	46	91	95	–	–	95	87
18–54	183	1089	32	27	37	72	2.2	4	19	76	91	78	96	170	75
55+	96	405	29	22	36	67	2.3	4	19	84	92	83	110	180	42
17–45[c]	134	813	36	31	42	76	2.1	4	19	91	95	91	120	170	85
All Ages and sex combined	545	3113	34	31	37	76	2.2	4	19	80	91	79	92	240	66

Abbreviations: CV = coefficient of variation; Max = maximum; Min = minimum; Freq = frequency; LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95; P50 = 50th percentile; n = number of people who reported engaging in activities (sample size)

[a]Sum of sampling weights for those who reported engaging in activities.

[b]Estimated percentage of the population who reported engaging in activities in the Local Area.

[c]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

Table 23. Estimated Time (hours/day) Spent Engaging in Activities in Water

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL95	UCL95	SD	CV	Min	Percentile			LTL95	UTL95	Max	Freq (%)[b]
									P50	P90	P95				
Males															
14–17	29	158	3.8	3.2	4.4	4.8	1.2	0.5	3.9	5.5	6.7	–	–	10	93
18–54	145	992	4.0	3.3	4.7	8.1	2.0	0.5	2.0	10	9.8	5.5	9.8	10	79
55+	60	282	3.6	2.8	4.3	6.3	1.8	0.5	2.0	9.2	9.6	5.5	9.9	10	40
Females															
14–17	29	162	4.5	3.3	5.6	7.6	1.7	0.5	2.0	10	8.9	5.1	8.8	10	87
18–54	181	1082	3.3	2.9	3.8	7.0	2.1	0.5	2.0	8.9	9.9	5.5	9.9	10	75
55+	96	405	2.6	2.1	3.2	5.8	2.2	0.5	2.0	5.5	7.7	5.4	8.1	10	42
17–45[c]	132	806	3.4	2.7	4.0	7.6	2.3	0.5	2.0	10	10	5.4	10	10	85
All ages and sex combined	540	3081	3.6	3.2	3.9	7.1	2.0	0.5	2.0	10	10	6.3	9.9	10	65

Abbreviations: Max = maximum; Min = minimum; Freq = frequency; LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95; n = number of people who reported using materials while engaging in activities (sample size)

[a]Sum of sampling weights for those who reported engaging in activities.

[b]Estimated percentage of the population who reported engaging in activities in the Local Area.

[c]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

5.3.1.2 Activities on Water

Approximately 1194 CCT residents engaged in activities on waters located within the Local Area. They spent an estimated 170 hours/person/year engaging in activities on Local Area waters (see

Tables 24–26). Approximately 104 hours/person/year, 26% of the total hours, were spent on waters of the UCR. The time spent by the CCT on waters within the Local Area followed a similar geographical pattern as the time they spent in the waters (Figure 4). Within the UCR, most of the time was spent in Reaches 4B and 6 (approximately 23,900 and 17,600 hours, respectively). The largest number of total hours per year within the Local Area was estimated for Zone 431 (approximately 30,200 hours) and Reach 7 (approximately 28,500 hours). Based on total hours, the largest contact rates were estimated for the southern and western regions of the Local Area. Estimates of the total annual hours and annual hours by CCT resource zone are presented in Table 24 and Figure 4.

EFs (days/year) and ETs (hours/day) by age and sex for activities on Local Area waters are presented in Tables 25 and 26. The mean EF for adults 55 years of age and older is higher than adults in the 18–54-year age category. The differences do not appear to be statistically significant ($p = 0.32$),[19] apparently due to the large variability in EFs. The mean EFs for the 14–17- and 18–54-year-old males are much higher than the corresponding females, but the trend reverses for adults 55 years of age and older ($p = 0.09$). There also appears to be substantial variability in the mean ETs between the males and females, although it may not be statistically significant ($p = 0.11$). ETs do not appear to differ substantially among the age groups ($p = 0.66$).

Table 24. Estimated Time (hours/person/year) Spent Engaging in Activities on Water

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
100	4.0	88	22
110	79	1772	23
120	39	2686	70
130	8.1	179	22
140	3.5	28	8.0
150	19	409	22
160	14	37	2.7
170	106	6820	65
180	64	1015	16
211	4.5	170	38
212	10	630	60
221	2.7	10	3.7
223	5.7	228	40
231	138	21495	156
233	4.0	88	22
250	27	1002	38
261	2.7	47	17
262	2.7	57	21
263	10	1502	146
271	3.6	156	44
282	27	232	8.5
291	52	3807	73
300	127	3016	24

[19] Test results are reported as the probability of observing a larger value of the Wald F-statistic.

Table 24. Estimated Time (hours/person/year) Spent Engaging in Activities on Water

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
311	132	9426	71
312	1.8	43	24
320	26	751	29
330	4.2	609	146
352	3.2	110	35
373	7.6	30	4.0
374	7.6	30	4.0
382	27	13222	496
421	4.9	10	2.0
422	38	1183	31
423	2.0	8.2	4.0
431	305	30181	99
432	49	918	19
441	8.1	146	18
442	4.5	42	9.4
461	1.8	13	7.0
462	1.8	13	7.0
481	2.0	8.1	4.0
888	11	2016	190
999	3.3	506	153
R3	8.3	891	108
R4A	63	4997	80
R4B	217	23892	110
R5	81	4514	56
R6	270	17644	65
R7	316	28537	90
R8	79	5617	71
R9	156	7886	50
R10	84	2944	35
R11	19	451	23
R12	4.9	128	26
R13	21	842	39
Local Area[e]	**1194**	**203082[f]**	**170**
UCR[g]	**498**	**51938[h]**	**104**
% In UCR	**42%**	**26%[i]**	–

[a]Zone 888 was assigned when the code recorded by the interviewer did not match an actual resource zone. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location. Shading indicates river reaches that are located within the UCR. Only zones that participants included in their responses are included.
[b]Estimated number of people who engaged in activities.
[c]Estimated total hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[d]Estimated total hours calculated by dividing the total estimated hours by the population size.
[e]Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).
[f]Total estimated hours spent engaging in activities within the Local Area; sum of the total hours estimated for each zone.
[g]Includes UCR River Reaches R1–R6.
[h]Total estimated hours spent engaging in activities within the UCR; sum of the total hours estimated for UCR River Reaches R1–R6.
[i]Percent of total annual hours spent engaging in activities in water within the UCR; estimated by dividing the total annual hours for UCR by the total annual hours for the Local Area.

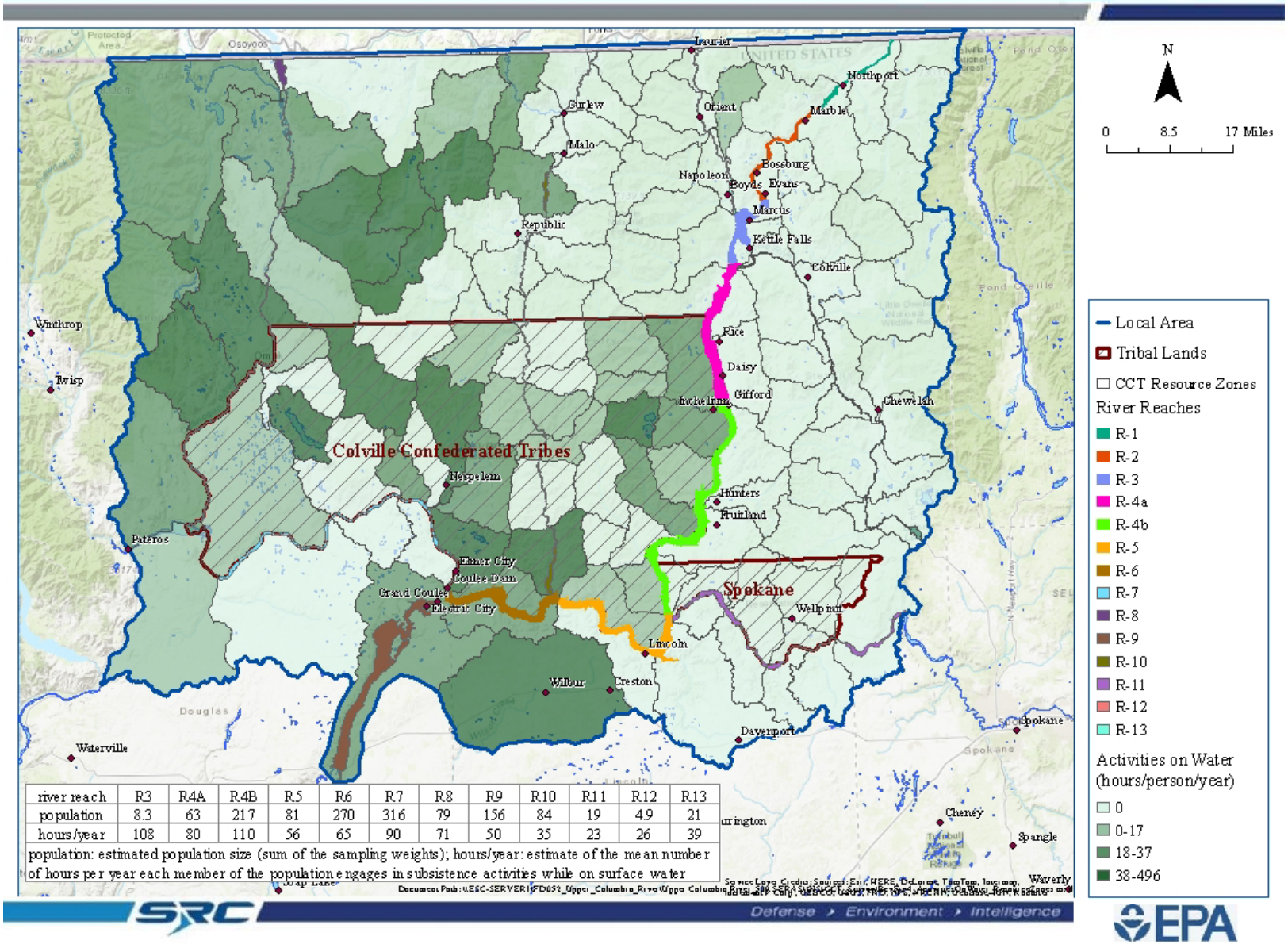


Figure 4. Activities on water by CCT resource zone.

Table 25. Estimated Frequency (days/year) Spent Engaging in Activities on Water

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL 95	UCL 95	SD	CV	Min	Percentile			LTL 95	UTL 95	Max	Freq (%)[b]
									P50	P90	P95				
Males															
14–17	5	44	67	23	110	170	2.5	4.0	88	110	110	–	–	110	26
18–54	63	445	29	22	37	72	2.5	4.0	19	65	76	–	–	120	35
55+	50	201	25	17	33	78	3.1	4.0	12	61	66	48	160	330	29
Females															
14–17	8	55	28	8.6	47	120	4.3	4.0	4.0	54	150	–	–	150	30
18–54	52	284	16	10	22	59	3.6	4.0	8.0	31	44	26	120	170	20
55+	37	165	30	15	45	88	2.9	4.0	12	95	110	–	–	170	17
17–45[c]	29	174	13	9.1	16	34	2.7	4.0	8.0	23	40	–	–	84	18
All ages and sex combined	215	1194	27	22	32	81	3	4.0	16	65	96	76	130	330	25

Abbreviations: Max = maximum; Min = minimum; Freq = frequency; LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95; n = number of people who reported using materials while engaging in activities (sample size)

[a]Sum of sampling weights for those who reported using materials while engaging in activities.

[b]Estimated percentage of the population who reported engaging in activities in the Local Area.

[c]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

Table 26. Estimated Time (hours/day) Spent Engaging in Activities on Water

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL 95	UCL 95	SD	CV	Min	Percentile			LTL 95	UTL 95	Max	Freq (%)[b]
									P50	P90	P95				
Males															
14–17	5	44	4.0	2.5	5.5	6.3	1.6	2.0	3.8	5.5	5.5	–	–	9.2	26
18–54	63	445	4.9	3.9	5.9	8.5	1.7	1.6	5.0	10	9.9	5.4	9.8	10	35
55+	49	193	4.1	3.4	4.8	5.0	1.2	0.5	4.6	6.3	8.4	5.5	9.7	10	27
Females															
14–17	8	55	3.6	2.4	4.8	5.3	1.5	0.5	5.0	5.5	5.4	0.95	5.5	5.5	30
18–54	51	281	3.6	3.0	4.2	5.1	1.4	0.5	2.0	5.5	7.2	5.5	9.9	10	19
55+	37	165	4.0	3.1	4.8	5.9	1.5	2.0	2.0	10	8.3	5.3	9.0	10	17
17–45[c]	28	171	3.2	2.7	3.7	3.9	1.2	0.5	2.0	5.5	5.5	2.9	5.4	9.4	18
All ages and sex combined	213	1183	4.3	3.8	4.7	6.5	1.5	0.5	3.8	10	9.8	5.5	9.7	10	25

Abbreviations: Max = maximum; Min = minimum; Freq = frequency; LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95; n = number of people who reported using materials while engaging in activities (sample size)

[a]Sum of sampling weights for those who reported using materials while engaging in activities.

[b]Estimated percentage of the population who reported engaging in activities in the Local Area.

[c]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

5.3.1.3 Activities on Land

Approximately 3102 CCT residents spend approximately 355 hours/person annually engaged in activities on land located within the Local Area (see Table 27). The largest number of total hours and hours were reported for Zone 180 (approximately 220,000 hours and 500 hours/person/year,

respectively). The CCT reported engaging in activities throughout the Local Area, including the northernmost zones located adjacent to the UCR. Based on total hours, the highest contact rates were estimated for the central and western regions of the Local Area. Estimates of the total annual hours and annual hours by CCT resource zone are presented in Table 27 and Figure 5.

Table 27. Estimated Time (hours/person/year) Spent Engaging in Activities on Land

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
100	61	3562	58
110	234	29274	125
120	157	31622	202
130	143	25258	177
140	64	6976	110
150	40	1428	36
160	41	925	22
170	262	34337	131
180	443	219952	497
190	20	3443	171
200	10	297	29
211	13	3304	256
212	46	1002	22
221	16	1829	114
222	133	29523	221
223	93	11675	126
231	142	12843	91
232	102	11816	116
233	88	6128	70
242	19	1189	63
250	196	9208	47
261	15	954	65
262	4.7	529	112
263	51	4120	81
271	17	823	49
272	23	743	32
281	72	13775	191
282	164	17288	105
291	280	35008	125
292	83	5657	68
300	292	33443	114
311	436	68170	156
312	141	8602	61
320	65	3910	60

Table 27. Estimated Time (hours/person/year) Spent Engaging in Activities on Land

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
330	175	5222	30
343	2.0	358	176
351	58	3837	66
352	25	1365	56
353	3.8	353	93
354	1.8	71	40
361	25	3344	135
362	15	48	3.3
363	31	6562	215
364	11	451	40
371	88	8615	98
372	63	3539	56
373	113	16387	145
374	76	11941	157
381	174	23853	137
382	291	75185	259
392	1.5	63	42
393	8.0	559	70
403	8.4	2053	244
404	4.2	145	35
411	14	2700	200
412	3.8	413	108
413	7.8	626	81
414	3.6	197	54
421	148	18209	123
422	183	25443	139
423	111	6833	61
431	286	37103	130
432	269	47341	176
441	172	17135	100
442	155	14879	96
451	48	3411	71
452	112	6818	61
453	98	7001	71
461	21	1915	93
462	62	3912	63
470	19	385	21
481	8.3	427	51
482	14	840	62
483	10	946	97

Table 27. Estimated Time (hours/person/year) Spent Engaging in Activities on Land

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
490	1.8	69	38
503	10	99	9.5
511	3.5	69	20
512	3.5	120	34
521	13	662	52
531	12	665	55
532	3.5	69	20
541	6.4	257	40
551	2.0	57	28
552	6.9	1988	288
563	2.0	6.4	3.2
564	2.0	6.4	3.2
572	10	99	9.5
582	1.5	63	42
583	1.5	63	42
592	5.0	179	35
602	1.8	143	80
611	1.5	60	40
612	2.0	25	13
613	11	898	81
614	14	484	35
622	2.0	17	8.4
623	2.0	17	8.4
888[a]	101	4314	43
999[a]	207	55045	265
R1[e]	2.1	520	252
R2[e]	2.1	520	252
R4A[e]	31	3751	119
R4B[e]	129	17751	138
R5[e]	39	1453	37
R6[e]	31	2453	78
R7[e]	19	1498	78
R8[e]	7.1	2367	335
R9[e]	19	1193	62
R10[e]	61	4936	80

Table 27. Estimated Time (hours/person/year) Spent Engaging in Activities on Land

CCT Resource Zone[a]	Population Size[b]	Annual Hours (hours/year)[c]	Annual Hours (hours/person/year)[d]
Local Area[f]	**3102**	**1101016**[g]	**355**
UCR[h]	**169**	**26449**[i]	**156**
% In UCR	**5%**	**2%**[j]	**–**

[a]Zone 888 was assigned when the code recorded by the interviewer did not match an actual resource zone. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location. Shading indicates river reaches that are located within the UCR. Only zones that participants included in their responses are included.
[b]Estimated number of people who engaged in activities.
[c]Estimated total hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[d]Estimated total hours calculated by dividing the total estimated hours by the population size.
[e]When participants provided a river reach as the location for on-land activities, it was assumed the participants referred to activities engaged in on the river bank.
[f] Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).
[g]Total estimated hours spent engaging in activities within the Local Area; sum of the total hours estimated for each zone.
[h]Includes UCR River Reaches R1–R6.
[i]Total estimated hours spent engaging in activities within the UCR; sum of the total hours estimated for UCR River Reaches R1–R6.
[j]Percent of total annual hours spent engaging in activities in water within the UCR; estimated by dividing the total annual hours for UCR by the total annual hours for the Local Area.

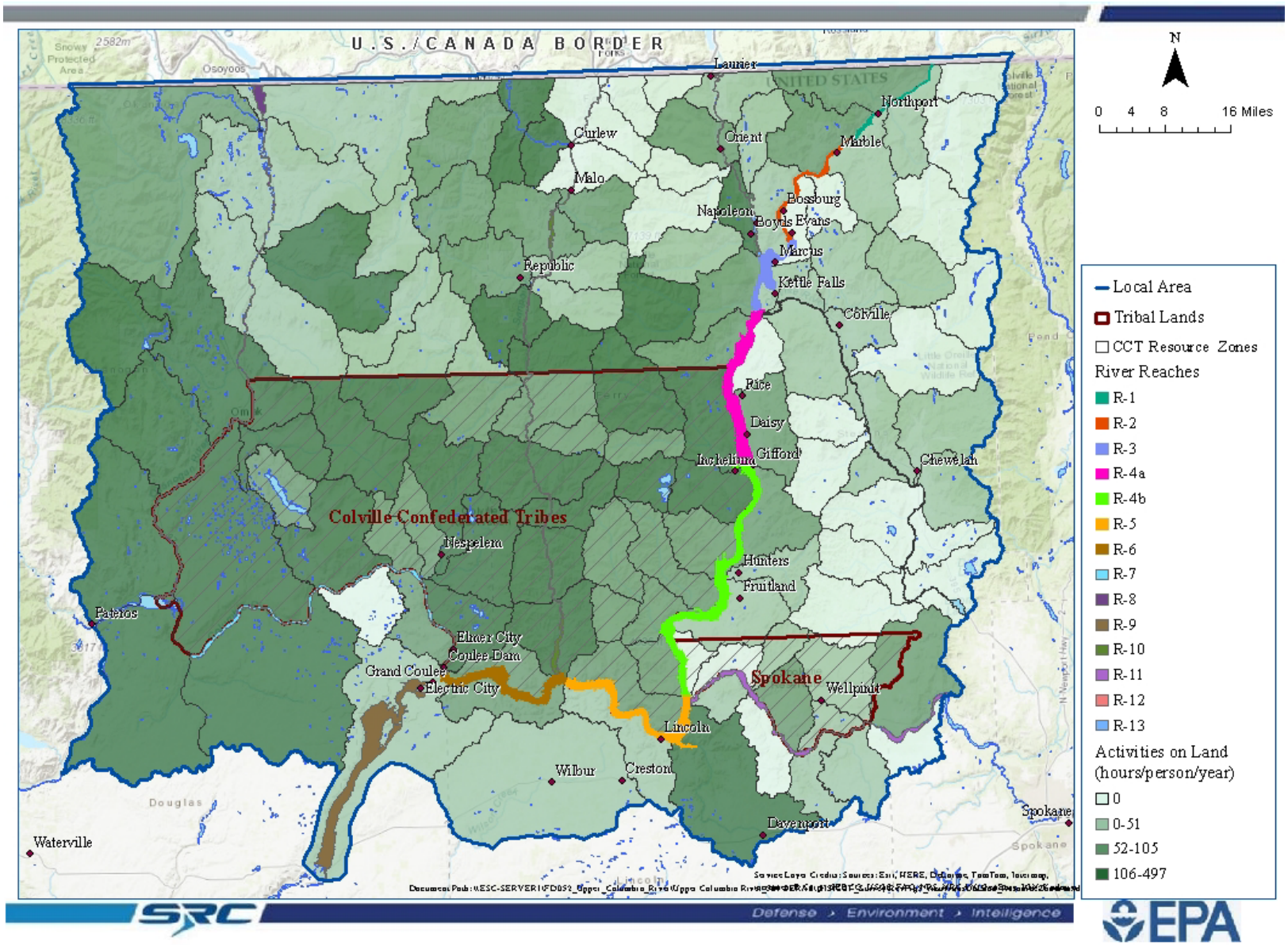


Figure 5. Activities on land by CCT resource zone.

EFs and ETs by age and sex for activities on land located within the Local Area are presented in Tables 28 and 29. In the 14–17- and 18–54-year-old age groups, the mean EF for males is substantially higher than females. In the 14–17-year-old age category, the mean EF for males (22 days/year) is almost 3 times the mean EF for females (8.1 days/year). These differences do not appear to be statistically significant, probably due to the large variability in EF for males and females. The estimated mean ETs ranged between 4.7 and 7.8 hours/day.

Table 28. Estimated Frequency (days/year) Spent Engaging in Activities on Land

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL 95	UCL 95	SD	CV	Min	Percentile			LTL 95	UTL 95	Max	Freq (%)[b]
									P50	P90	P95				
Males															
14–17	18	97	22	13	30	56	2.6	1.0	14	55	66	–	–	91	57
18–54	137	905	19	15	23	52	2.7	1.0	14	46	69	47	90	91	72
55+	95	407	20	14	27	54	2.6	1.0	7.8	65	88	–	–	91	58
Females															
14–17	24	130	8.1	4	12	27	3.3	1.0	2.0	22	40	–	–	42	70
18–54	181	1022	16	13	19	43	2.7	1.0	6.8	46	46	45	57	91	71
55+	131	541	20	16	24	44	2.2	1.0	14	53	67	53	88	91	57
17–45[c]	118	641	12	8.5	15	34	2.9	1.0	4.8	39	44	39	55	62	67
All ages and sex combined	586	3102	18	16	20	47	2.6	1.0	11	46	62	50	78	91	66

Abbreviations: Max = maximum; Min = minimum; Freq = frequency; LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95; n = number of people who reported using materials while engaging in activities (sample size)

[a]Sum of sampling weights for those who reported engaging in activities on land.

[b]Estimated percentage of the population who reported engaging in activities in the Local Area.

[c]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

Table 29. Estimated Time (hours/day) Spent Engaging in Activities on Land

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL 95	UCL 95	SD	CV	Min	Percentile			LTL 95	UTL 95	Max	Freq (%)[b]
									P50	P90	P95				
Males															
14–17	18	97	6.0	4.6	7.5	7.1	1.2	2.0	5.0	10	9.8	4.8	9.9	10	57
18–54	137	905	5.3	4.7	5.9	8.0	1.5	0.5	5.4	10	9.9	7.6	9.9	10	72
55+	94	402	5.1	4.6	5.7	6.2	1.2	0.5	5.5	10	9.9	7.5	9.9	10	57

Table 29. Estimated Time (hours/day) Spent Engaging in Activities on Land

Age Group (years)	n	Sum of Sampling Weights[a]	Mean	LCL 95	UCL 95	SD	CV	Min	Percentile			LTL 95	UTL 95	Max	Freq (%)[b]
									P50	P90	P95				
Females															
14–17	24	130	7.8	6.7	8.8	6.9	0.88	1.9	10	10	10	4.7	9.9	10	70
18–54	178	1008	5.3	4.7	5.8	7.8	1.5	0.5	5.5	10	10	6.1	9.9	10	70
55+	129	531	4.7	4.2	5.2	6.4	1.3	0.5	4.2	10	9.5	7	8.9	10	56
17–45[c]	115	628	6.3	5.7	7.0	7.3	1.2	1.7	5.5	10	9.9	5.5	9.7	10	66
All ages and sex combined	580	3073	5.3	5.0	5.6	7.3	1.4	0.5	5.5	10	10	8.4	9.9	10	65

Abbreviations: Max = maximum; Min = minimum; Freq = frequency; LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95; n: number of people who reported using materials while engaging in activities (sample size)

[a]Sum of sampling weights for those who reported engaging in activities on land.

[b]Estimated percentage of the population who reported engaging in activities in the Local Area.

[c]This age group will be used for estimating hazards from methylmercury and lead for women of childbearing potential (U.S. EPA, 2001, 2003).

5.3.2 Tribal Practices

The ReUP captured information on the frequency, duration, and contact rates within the past year, as well as the types of materials or resources (e.g., species) that were utilized as part of traditional tribal practices. These practices included:

- Weaving and carving;
- Dyeing and coloring;
- Construction of shelters/large objects;
- Sweat lodges;
- Medicinal, spiritual, or traditional practices;
- Face and body painting; and
- Other non-dietary traditional practices.

This section of the report provides an overview of the location, total hours, and the annual hours (hours/person/year) that CCT residents used selected resources harvested from the Local Area while engaging in the traditional practices listed above. Population sizes and annual hours are summarized in Tables 30 and 31. As described in Section 5.2, the survey database includes a small percentage of responses that identify one of the UCR Reaches as the source of a resource when this appears to be incorrect (e.g., deer). The data are described as reported; however, this apparent source of uncertainty should be kept in mind when interpreting the results.

Table 30. Summary of Population Size and Annual Hours of Resource Use During Tribal Practices (Weaving, Sweat Lodge, Face and Body Painting)

Resource Zone/ River Reach	Weaving: Animal Materials[a]		Weaving: Plant Materials[b]		Sweat Lodge[c]		Face and Body Painting[d]	
	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]
110	2	45	–	–	–	–	–	–
160	–	–	–	–	7	28	–	–
170	–	–	2	14	154	95	–	–
180	20	314	69	33	74	37	–	–
221	–	–	–	–	1	0	–	–
222	6	190	16	17	31	232	–	–
223	–	–	14	21	200	42	–	–
231	5	14	40	17	2	5	–	–
232	–	–	–	–	8	10	–	–
233	–	–	37	5	115	481	–	–
242	–	–	–	–	3	5	–	–
250	–	–	–	–	–	–	3	10
271	–	–	–	–	7	28	4	10
282	14	9	6	26	–	–	–	–
291	2	30	26	14	187	13	–	–
292	2	30	6	26	51	24	–	–
300	4	17	35	68	101	20	–	–
311	–	–	24	26	47	28	34	10
312	–	–	2	6	–	–	–	–
320	–	–	2	4	–	–	–	–
364	–	–	–	–	2	10	–	–
371	–	–	–	–	31	370	–	–
372	14	9	–	–	8	10	–	–
374	–	–	–	–	4	250	–	–
381	–	–	14	28	–	–	–	–
382	26	52	128	121	170	386	5	50

Table 30. Summary of Population Size and Annual Hours of Resource Use During Tribal Practices (Weaving, Sweat Lodge, Face and Body Painting)

	Weaving: Animal Materials[a]		Weaving: Plant Materials[b]		Sweat Lodge[c]		Face and Body Painting[d]	
Resource Zone/ River Reach	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]
413	–	–	32	10	–	–	–	–
421	4	58	1	10	21	68	–	–
422	4	56	27	23	36	47	–	–
423	2	250	52	46	31	7	–	–
431	13	51	57	90	51	23	–	–
432	11	44	72	30	53	42	–	–
441	8	42	–	–	–	–	–	–
442	18	12	4	10	15	55	–	–
451	4	60	–	–	–	–	–	–
452	4	60	–	–	–	–	–	–
453	4	23	–	–	–	–	–	–
461	–	–	–	–	4	40	–	–
481	–	–	2	6	–	–	–	–
482	–	–	7	37	–	–	–	–
511	–	–	5	110	–	–	–	–
542	–	–	3	10	–	–	–	–
999[g]	18	59	147	261	399	138	4	10
R1	–	–	3	55	–	–	–	–
R2	–	–	–	–	–	–	–	–
R3	–	–	–	–	–	–	–	–
R4A	4	90	11	43	–	–	–	–
R4B	15	73	4	200	29	40	4	15
R5	–	–	–	–	14	34	–	–
R6	–	–	35	14	–	–	–	–

Table 30. Summary of Population Size and Annual Hours of Resource Use During Tribal Practices (Weaving, Sweat Lodge, Face and Body Painting)

Resource Zone/ River Reach	Weaving: Animal Materials[a]		Weaving: Plant Materials[b]		Sweat Lodge[c]		Face and Body Painting[d]	
	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]	Population Size[e]	Annual Hours (hours/person/year)[f]
Local Area[h]	**123**	**125**	**260**	**289**	**495**	**484**	**32**	**23**
UCR	**15**	**97**	**53**	**36**	**43**	**38**	**4**	**15**

[a]Animals harvested from the Local Area included: deer, elk, eagles, hawks, and moose.
[b]Plants harvested from the UCR included: cattails, driftwood, green willow, ocean spray, red willow, syringa, and wild rose.
[c]Water was the only material harvested from the UCR.
[d]Materials harvested from the Local Area included minerals and clay.
[e]Estimated number of members of the CCT population who use the indicated resource.
[f]Calculated by dividing the total estimated hours by the estimated population size.
[g]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[h]Includes all CCT resource zones (including UCR River Reaches R1–R6, and Zone 999).

Table 31. Summary of Population Size and Annual Hours of Resource Use During Tribal Practices (Medicinal and Spiritual, Dyeing and Coloring, Construction, and Other Materials)

Resource Zone/ River Reach	Medicinal and Spiritual[a]		Other Materials[b]		Dyeing and Coloring[c]		Construction: Animals[d]		Construction: Plants[d]	
	Population Size[e]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]
110	–	–	23	103	–	–	–	–	–	–
120	–	–	–	–	–	–	22	10	94	48
130	–	–	–	–	–	–	–	–	18	50
160	–	–	6	990	–	–	–	–	–	–
170	–	–	6	68	–	–	–	–	35	57
180	–	–	21	46	2	100	–	–	5	3
190	–	–	–	–	2	100	–	–	–	–
221	–	–	7	10	–	–	–	–	–	–
222	–	–	10	360	–	–	–	–	9	189
223	–	–	6	495	–	–	–	–	48	61
231	–	–	4	28	–	–	–	–	9	20
232	–	–	10	305	–	–	–	–	24	25
233	–	–	7	450	–	–	–	–	49	21
242	8	1	–	–	–	–	–	–	–	–
273	–	–	–	–	–	–	–	–	62	51
281	–	–	–	–	–	–	–	–	53	161
282	–	–	–	–	7	28	–	–	113	7
291	–	–	3	3	42	28	–	–	235	50
292	–	–	–	–	–	–	–	–	28	14
300	–	–	28	1311	–	–	–	–	129	14
311	8	0	26	10	17	10	–	–	64	25
312	–	–	15	3	–	–	–	–	–	–
362	–	–	6	1800	–	–	–	–	7	110
371	4	0	11	755	–	–	–	–	–	–
374	–	–	–	–	–	–	–	–	10	110
382	172	9	6	54	–	–	–	–	151	53

Table 31. Summary of Population Size and Annual Hours of Resource Use During Tribal Practices (Medicinal and Spiritual, Dyeing and Coloring, Construction, and Other Materials)

Resource Zone/ River Reach	Medicinal and Spiritual[a]		Other Materials[b]		Dyeing and Coloring[c]		Construction: Animals[d]		Construction: Plants[d]	
	Population Size[e]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]	Population Size[a]	Annual Hours (hours/per/year)[f]
412	–	–	–	–	–	–	–	–	16	29
413	–	–	–	–	–	–	–	–	2	27
421	73	2	8	431	4	1	–	–	39	160
422	131	1	7	146	1	1	–	–	58	23
423	61	2	8	457	4	1	–	–	20	10
431	98	4	20	365	7	9	–	–	23	20
888[g]	10	0.3	–	–	–	–	–	–	76	17
999[g]	248	0.9	71	1231	14	173	3	2.5	146	134
R1	–	–	–	–	–	–	–	–	–	–
R2	–	–	–	–	–	–	–	–	–	–
R3	–	–	–	–	–	–	–	–	–	–
R4A	–	–	–	–	–	–	–	–	–	–
R4B	9	3.0	–	–	–	–	–	–	–	–
R5	–	–	–	–	2	2.5	–	–	–	–
R6	–	–	14	28	–	–	–	–	–	–
Local Area[h]	**229**	**13**	**285**	**690**	**68**	**68**	**25**	**9.1**	**535**	**155**
UCR	**9**	**3.0**	**14**	**28**	**2**	**2.5**	**–**	**–**	**–**	**–**

[a]Wild rose was the only material harvested from the UCR.
[b]Driftwood was the only "other material" harvested from the UCR.
[c]River birch was the only material harvested from the UCR.
[d]No plant or animal materials were not harvested from the UCR.
[e]Estimated number of members of the CCT population who use the indicated resource.
[f]Calculated by dividing the total estimated hours by the estimated population size.
[g]CCT Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[h]Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).

5.3.2.1 Materials Used for Weaving and Carving

The ReUP collected information on the amount of time per year spent weaving and carving as well as the frequency of using materials from the Local Area. The ReUP also provided information on whether the material was placed in the mouth during weaving. The ReUP captured natural plant or animal materials used for weaving, carving, and tool making practices (e.g., mats, baskets, fish nets, baby boards). Materials that were used or prepared (i.e., cut, soak, mellow, split, thin, break, smoke, or tan) for these practices were recorded.

Animal Materials Used for Weaving and Carving

Approximately 123 CCT residents spent an estimated 125 hours/person annually using animal materials from the Local Area for weaving and/or carving (Table 32). Additional data were also collected on the animal materials (e.g., bones, brains, antlers) that were utilized (see Appendices E and F). The highest number of hours (approximately 6400) was reported for Zone 180. Materials obtained from the Local Area include: deer (antlers, bones, brains, and hides), elk (antlers, brains, and teeth), eagle and hawk (feathers), and moose (hides). All population- and material-specific data are available in Appendices and F.

Table 32. Estimated Hours/Year that Involved the Use of Animal-based Materials Used for Traditional Weaving Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
110	1	–	2	106	45
180	5	–	20	6415	314
222	2	–	6	1218	190
231	2	–	5	75	14
282	1	–	14	126	9.2
291	1	–	2	62	30
292	1	–	2	62	30
300	2	–	4	73	17
372	1	–	14	126	9.2
382	5	–	26	1362	52
421	2	–	4	206	58
422	2	–	4	233	56
423	1	–	2	518	250
431	4	–	13	663	51
432	3	–	11	499	44
441	3	–	8	323	42
442	2	–	18	213	12
451	2	–	4	237	60
452	2	–	4	237	60
453	1	–	4	87	23
999[f]	5	–	18	1082	59

Table 32. Estimated Hours/Year that Involved the Use of Animal-based Materials Used for Traditional Weaving Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
R4A	2	–	4	355	90
R4B	5	–	15	1113	73
Local Area (Total)[g]	**32**	**–**	**123**	**15390**	**125**
UCR	**5**	**0**	**15**	**1468**	**97**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]CCT Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6 and Zone 999).

Plant Materials Used for Weaving and Carving Practices

CCT members used many plant materials (e.g., red willow, wild rose, cattails) for weaving and carving practices. The mean annual time spent using these materials from the Local Area was 289 hours/person (Table 33). The annual time spent using plant materials harvested from the UCR for weaving or carving was 36 hours/person (Table 33). The time spent using materials from the UCR represented approximately 2.6% of the total hours estimated for the Local Area (Table 33). The materials obtained from the UCR included:

- Reach 1: red willow;
- Reach 4A: green willow, red willow, and syringa;
- Reach 4B: wild rose; and
- Reach 6: cattails, ocean spray, and driftwood.

The location (CCT resource zone) and annual hours (hours/person/year) spent using materials obtained from the Local Area are presented in Table 33. All population- and material-specific EFs (days/year), ETs (hours/day), and mouthing frequencies reported in the ReUP are available in Appendices C and D.

Table 33. Estimated Hours/Year that Involved the Use of Plant-based Materials Used for Traditional Weaving Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
All Materials					
170	1	–	2	29	14
180	10	–	69	2278	33
222	5	1	16	272	17
223	2	1	14	280	21
231	12	1	40	678	17

Table 33. Estimated Hours/Year that Involved the Use of Plant-based Materials Used for Traditional Weaving Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
233	7	–	37	195	5.3
282	2	–	6	154	26
291	6	–	26	358	14
292	3	–	6	156	26
300	7	–	35	2399	68
311	4	–	24	644	26
312	1	–	2	13	6.0
320	1	–	2	8.6	4.0
381	1	–	14	379	28
382	24	–	128	15511	121
413	3	1	32	318	10
421	1	–	2	15	10
422	10	–	27	641	23
423	7	–	52	2374	46
431	21	–	57	5138	90
432	18	1	72	2138	30
442	2	–	4	43	10.0
481	1	1	2	14	6.0
482	3	–	7	263	37
511	1	–	5	588	110
542	1	–	3	31	10
999[f]	28	–	147	38270	261
R1	1	–	3	151	55
R4A	3	–	11	466	43
R4B	2	–	4	789	200
R6	3	–	35	514	14
R7	1	–	8	80	10
R8	1	–	4	9.1	2.5
R10	1	–	2	56	28
Local Area[g]	**53**	**-**	**260**	**75254**	**289**
UCR	**9**	**0**	**53**	**1920**	**36**
% From UCR[h]		**–**	**–**	**2.6%**	**–**
Cattails Only					
422	1	–	5.3	214	40
432	1	–	1.5	42	27
442	1	–	2.7	27	10
999[f]	1	–	4.6	504	110
R6	1	–	17	169	10
R8	1	–	3.6	9.1	2.5
Local Area[g]	**–**	**–**	**–**	**965**	**–**
UCR	**1**	**–**	**17**	**169**	**9.9**
% From UCR[h]		**–**	**–**	**18%**	**–**

Table 33. Estimated Hours/Year that Involved the Use of Plant-based Materials Used for Traditional Weaving Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
Driftwood Only					
R6	1	–	8	239	30
R7	1	–	8	80	10
Local Area[g]	**2**	**–**	**–**	**318**	**-**
UCR	**1**	**–**	**8**	**239**	**30**
% From UCR[h]		**–**	**–**	**75%**	**–**
Green Willow					
180	1	–	2.3	5.8	2.5
233	1	–	3.8	9.5	2.5
311	1	–	13	125	10
382	1	–	2.7	27	10
422	1	–	2.4	5.9	2.5
431	3	–	6.0	165	28
999[f]	2	–	8.4	3364	402
R4A	1	–	2.7	302	110
Local Area[g]	**-**	**–**	**–**	**4004**	**-**
UCR	**1**	**–**	**3**	**302**	**112**
% From UCR[h]		**–**	**–**	**7.5%**	**–**
Ocean Spray					
431	2	–	4	108	27
432	1	–	2	40	28
R6	1	–	11	106	10
Local Area[g]	**-**	**–**	**–**	**255**	**-**
UCR	**1**	**–**	**11**	**106**	**9.6**
% From UCR[h]		**–**	**–**	**42%**	**–**
Red Willow					
180	1	–	2	5.8	2.5
223	1	–	7	187	28
231	1	–	2	3.6	1.7
233	2	–	18	147	8.4
282	1	–	4	152	40
291	1	–	13	125	10
300	2	–	13	108	8.5
382	2	–	13	1404	110
421	1	–	12	15	10
422	2	–	8	77	10
423	1	–	2	83	40
431	3	–	6	261	43
432	2	–	9	247	28
999[f]	2	–	8	3364	402
R1	1	–	3	151	55
R4A	1	–	3	151	55

Table 33. Estimated Hours/Year that Involved the Use of Plant-based Materials Used for Traditional Weaving Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
R10	1	–	2	56	28
Local Area[g]	**-**	**–**	**–**	**6537**	**–**
UCR	**2**	**0**	**5**	**302**	**55**
% From UCR[h]		**–**	**–**	**4.6%**	**–**
Syringa					
R4A	1	–	5	13	2.5
Local Area[g]	**1**	**–**	**–**	**13**	**2.5**
UCR	**1**	**–**	**–**	**13**	**2.5**
% From UCR[h]		**–**	**–**	**100%**	**–**
Wild Rose					
180	1	–	2	5.8	2.5
291	1	–	2	6.8	3.3
292	1	–	2	6.8	3.3
300	1	–	2	6.8	3.3
382	3	–	15	1431	93
432	2	–	21	1008	48
999[f]	1	–	4	2860	755
R4B	2	–	4	789	200
Local Area[g]	**-**	**–**	**–**	**6114**	**–**
UCR	**2.0**	**–**	**–**	**789**	**200**
% From UCR[h]		**–**	**–**	**13%**	**–**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.2.2 Materials Used for Sweat Lodges

CCT residents used several materials (e.g., water, bunchgrass, sages) for sweat lodge practices. Overall, CCT residents spent an estimated 484 hours/person annually using materials from the Local Area and an estimated 38 hours/person annually using materials from the UCR for sweat lodge practices (Table 34). Water was obtained primarily from River Reaches 4B and 5. The hours spent using materials from the UCR represented less than 1% of the total hours spent using materials harvested from the Local Area (Table 34). Materials were also used from River Reaches 8 and 10. These materials included cedar, fir, and sages (Reach 8) and water (Reach 8 and 10) (see Appendices E and F).

The location (CCT resource zone) and annual hours (hours/person/year) usage rates for materials used while engaged in sweat lodge practices are presented in Table 34. Estimated EFs (days/year), ETs (hours/day), and mouthing frequencies for each material used while engaging in sweat lodge practices are available in Appendices E and F.

Table 34. Estimated Hours/Year that Involved the Use of Local Materials Used for Traditional Sweat Lodge Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
All Materials					
160	1	–	7	186	28
170	9	–	154	14577	95
180	13	–	74	2739	37
221	1	–	2	0.3	0.2
222	9	–	31	7074	232
223	17	1	200	8447	42
231	1	–	2	11	5.0
232	2	–	8	78	10.0
233	15	2	115	55325	481
242	1	–	3	13	5.0
271	1	–	7	187	28
291	25	2	187	2499	13
292	12	–	51	1226	24
300	21	1	101	2037	20
311	7	–	47	1300	28
364	1	–	2	20	10
371	2	–	31	11597	370
372	2	–	8	78	10.0
374	1	–	4	948	250
382	32	–	170	65793	386
421	9	–	21	1447	68
422	17	–	36	1674	47
423	12	–	31	209	6.8
431	12	–	51	1158	23
432	20	–	53	2227	42
442	8	–	15	810	55
461	1	–	4	152	40
999[f]	62	1	399	55044	138
R4B	9	–	29	1154	40
R5	3	–	14	480	34
R8	5	–	32	746	23
R10	1	–	7	140	21
Local Area[g]	**86**	**–**	**495**	**239376**	**484**
UCR	**12**	**–**	**43**	**1634**	**38**
% From UCR[h]	**–**	**–**	**–**	**0.68**	**–**
Water Only					
170	3	–	24	419	18
180	4	–	49	1923	39
222	5	–	16	3167	192
223	3	–	28	718	25

Table 34. Estimated Hours/Year that Involved the Use of Local Materials Used for Traditional Sweat Lodge Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
232	2	–	8	78	10.0
233	5	–	55	27618	499
291	9	–	92	1652	18
292	6	–	34	1135	34
300	8	–	47	904	19
311	5	–	41	813	20
371	1	–	4	152	40
382	6	–	26	1021	40
421	1	–	2	223	110
422	4	–	8	335	41
423	1	–	2	1.9	1.3
431	2	–	4	26	6.7
432	8	–	26	805	31
442	2	–	3	179	60
999[f]	8	–	36	3910	107
R10	1	–	7	140	21
R4B	9	–	29	1154	40
R5	3	–	14	480	34
R8	2	–	26	685	26
Local Area[g]	**–**	**–**	**–**	**47539**	**–**
UCR	**–**	**–**	**–**	**1634**	**–**
% From UCR[h]	**–**	**–**	**–**	**3.4%**	**–**

Note: Responses that involved water and another substance (e.g., "water and peyote") were not included in this table.
[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.2.3 Materials Used for Face and Body Painting

The ReUP provided information on exposure pathways associated with Face and Body Painting scenario: (1) EF (events/year) and the fraction of material from the UCR and (2) dermal contact with plants or other materials from the UCR. For this analysis, traditional face and body painting practices were considered ceremonial practices only. Exposures through oral and inhalation routes were not reported.

CCT members reported using materials (e.g., minerals, clay, and bones) for face and body painting practices. On average, individuals spent an estimated 23 hours/person annually using materials from the Local Area (see Table 35). Two survey participants (~4 CCT members) reported using materials from the UCR; the estimated time they spent using these materials is 15 hours/person annually. These

individuals accounted for approximately 8.5% of the estimated total hours from the Local Area (Table 35). Minerals and clay were obtained from River Reach 4B (5 hours/person/year; Table 35).

The location (CCT resource zone) and annual time spent using the materials obtained from the Local Area are presented in Table 35. Estimated EFs and ETs for each material used for face and body painting are provided in Appendices E and F.

Table 35. Estimated Hours/Year that Involved the Use of Materials Used for Face and Body Painting Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated annual hours (hours/year)[d]	Annual hours (hours/person/year)[e]
All Materials					
250	1	–	3	31	10
271	1	–	4	36	10
311	2	–	34	338	10
382	1	–	5	229	50
999[f]	1	–	4	36	10
R4B	2	–	4	62	15
Local Area[g]	**6**	–	**32**	**732**	**23**
UCR	**2**	–	**4**	**62**	**15**
% From UCR[h]	–	**–**		**8.5**	**–**
Minerals and Clay Only					
250	1	–	3	16	5
311	1	–	17	85	5
382	1	–	4.6	23	5
R4B	2	–	4.1	21	5
Local Area[g]	–	**–**	**–**	**144**	–
UCR	–	**–**	**–**	**21**	–
% From UCR[h]	–	**–**		**15**	**–**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.2.4 Materials and Procedures Used for Medicinal, Spiritual, or Traditional Practices

The ReUP provided information on the time spent in contact with local materials while participating in medicinal/ceremonial practices. The ReUP questionnaire collected data on the types of plants used, the amount sourced locally and how specific parts of the plant (e.g., seeds, flowers, and roots) were used. The Tribal Survey did not collect data on the frequency (days/year) of exposure to these materials. Subsequently, six plants were identified as medicinal plants of interest because they were the most popularly reported: sage, cedar, wild rose, juniper, kinnikinick, and wild mint (Environment International [EI], 2013). As discussed in EI (2013), the CCT and EI conducted a follow-up survey to

collect data for these six plants; specifically: the frequency (days/year) of medicinal, spiritual, or traditional uses (e.g., tea, applying to skin, smudging) and potential routes of exposure (e.g., oral, dermal, inhalation).

CCT residents who used one or more of the six plants identified above for medicinal, spiritual, or traditional practices spent an estimated 13 hours/person annually using the materials harvested from the Local Area (Table 36). Residents who harvested one or more of the six plants from the UCR spent an estimated 3 hours/person annually using them for medicinal and/or spiritual practices. The hours spent using the plants harvested from the UCR represented approximately 1% of the hours spent using the six plants from all of the Local Area (Table 36). The materials obtained from Reach 4B included wild rose (4.5 hours/person/year) and mint (ETs were not reported). Wild rose from this area was used for smudging (seeds, flowers) and for tea (seeds, flowers, roots).

The location (CCT resource zone) and annual hours (hours/person/year) spent using materials obtained for medicinal, spiritual, and traditional practices, are presented in Table 36. Estimated EFs and ETs for the six plants are provided in Appendices E and F.

Table 36. Estimated Hours/Year Spent Using Materials for Medicinal, Spiritual, and Traditional Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
All Materials					
242	3	11	8	4.7	0.6
311	3	82	8	0.0	0.0
371	3	4	5	1.3	0.3
382	23	183	172	1562	9.1
421	24	53	73	147	2.0
422	53	188	131	86	0.7
423	24	49	61	127	2.1
431	42	133	98	353	3.6
432	61	200	210	410	2.0
442	8	60	16	5.6	0.3
888	3	4	10	2.8	0.3
999[f]	70	1212	248	215	0.9
R4B	5	30	9.1	28	3.0
Local Area[g]	**68**	**–**	**229**	**2942**	**13**
UCR	**5**	**–**	**9**	**28**	**3.0**
% From UCR[h]	**–**		**–**	**0.95**	**–**
Wild Rose					
382	6	40	38	86	2.3
421	3	4	4.5	1.3	0.3
422	6	9	15	2.1	0.1
423	3	3	5	5.2	1.2
431	6	9	11	3.1	0.3
432	24	45	55	17	0.3

Table 36. Estimated Hours/Year Spent Using Materials for Medicinal, Spiritual, and Traditional Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
999[f]	9	26	38	5.3	0.1
R4B	3	11	6	28	4.5
Local Area[g]	**–**	**–**	**–**	**148**	**–**
UCR	**3**	**11**	**6**	**28**	**4.5**
% From UCR[h]	**–**		**–**	**19**	**–**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF (this data was not collected for all but 6 plants).
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.2.5 Other Materials Used for Traditional Practices

The ReUP included an additional nine questions to collect data for use of any non-dietary natural resources or materials that were not discussed elsewhere in the survey. The materials reported in this category were primarily plant materials (e.g., cedar boughs, driftwood, firewood), but also included buckskin, sand, pebbles, gravel, and compost. The annual time spent using these materials from the Local Area was 690 hours/person (Table 37).

The location (CCT resource zone) and time spent using the "other" materials are presented in Table 37. Estimated EFs and ETs for the "other" materials are provided in Appendices E and F.

Table 37. Estimated Hours/Year that Involved the Use of "Other Materials" used for Traditional Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
All Materials					
110	2	–	23	2412	103
160	1	–	6	5970	990
170	2	–	6	388	68
180	3	–	21	976	46
221	1	–	7	68	10
222	2	–	10	3660	360
223	1	–	6	2890	495
231	2	–	4	114	28
232	2	–	10	2928	305
233	1	–	7	3104	450
291	1	–	3	8.0	2.5
300	3	–	28	36798	1311
311	2	–	26	260	10
312	2	–	15	38	2.5

Table 37. Estimated Hours/Year that Involved the Use of "Other Materials" used for Traditional Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
362	2	–	6	11370	1800
371	2	–	11	8552	755
382	2	–	6	321	54
421	4	–	9	3645	431
422	3	–	7	1040	146
423	4	–	9	3868	457
431	7	–	20	7304	365
432	6	–	13	2860	212
441	4	–	13	2180	169
442	1	–	2	457	225
451	3	–	11	5605	502
452	1	–	2	46	22
453	2	–	4	960	233
462	1	–	2	138	66
481	1	–	2	914	450
999[f]	15	2	71	87345	1231
R6	1	–	14	379	28
Local Area[g]	**55**	**–**	**285**	**196598**	**690**
UCR	**1**	**–**	**14**	**379**	**28**
% From UCR[h]	**–**	**–**	**–**	**0.19**	**–**
Driftwood					
R6	1	–	14	379	28
Local Area[g]	**1**	**–**	**14**	**379**	**28**
UCR	**1**	**–**	**14**	**379**	**28**
% From UCR[h]	**–**	**–**	**–**	**100**	**–**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.2.6 Materials Used for Dyeing and Coloring

CCT residents reported using materials (e.g., red willow, wild rose, cattails) for dyeing and coloring practices. Overall, CCT residents who used natural materials harvested from the Local Area for dyeing and coloring on average spent an estimated 68 hours/person annually using these materials (Table 38). One participant (~2 CCT members) reported using river birch from River Reach 5. The location (CCT resource zone) and annual time spent using materials from the Local Area for traditional dyeing and coloring practices are presented in Table 38. Estimated EFs and ETs for the each of the materials used for dyeing and coloring are provided in Appendices E and F.

Table 38. Estimated Hours/Year that Involved the Use of Materials used for Traditional Dyeing and Coloring Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
All Materials					
180	1	–	2	232	100
190	1	–	2	232	100
282	1	–	7	187	28
291	2	–	42	1151	28
311	1	–	17	169	10
421	3	–	4.5	2.4	0.5
422	1	–	2	0.93	0.6
423	3	–	5	2.4	0.5
431	4	–	6	59.3	9.1
432	4	–	7	138	19
442	1	–	2	7.5	5.0
583	2	–	3	1.5	0.5
592	2	–	3	1.5	0.5
999[f]	2	–	14	2445	173
R5	1	–	2	5.3	2.5
Local Area[g]	**10**	**–**	68	**4635**	**68**
UCR	**1**	**–**	**2**	**5.3**	**2.5**
% From UCR[h]	**–**	**–**	**–**	**0.12**	**–**
River Birch					
R5	1	–	–	5.3	2.5
Local Area[g]	**1**	**–**	–	**5.3**	**2.5**
UCR	**1**	**–**	**–**	**5.3**	**2.5**
% From UCR[h]	**1**	**–**	**–**	**100**	**–**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.2.7 Materials Used for Construction of Shelters and Large Objects

The ReUP provided information on the time spent using material from the UCR for construction. CCT residents reported using several plant materials (e.g., birch bark, cattails, cedar) for construction practices. On average, CCT members spent an estimated 155 hours/person annually using plant materials from the Local Area (Table 39). Participants did not report using materials from the UCR (Table 39).

Plant materials were obtained from River Reaches 8 (wild rose) and 10 (red willow). The location (CCT resource zone) and annual hours spent using materials for construction are presented in Table 39. Estimated EFs and ETs for the each of the materials used for construction are provided in Appendices E and F.

Table 39. Estimated Hours/Year that Involved the Use of Plant Materials used for Construction Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
120	5	–	94	4498	48
130	2	–	18	898	50
170	3	–	35	2005	57
180	1	–	5	12	2.5
222	2	–	9	1766	189
223	6	–	48	2932	61
231	2	–	9	192	20
232	2	–	24	581	25
233	8	–	49	1027	21
273	2	–	62	3160	51
281	6	–	53	8593	161
282	3	–	113	755	6.7
291	20	–	235	11782	50
292	7	–	28	400	14
300	20	–	129	1828	14
311	5	–	64	1583	25
362	2	–	7	738	110
374	1	–	10	1078	110
382	23	1	151	8074	53
412	2	–	16	461	29
413	1	–	3	67	27
421	18	–	39	6292	160
422	27	–	58	1355	23
423	11	–	20	210	10
431	12	–	23	453	20
432	12	–	25	556	22
441	3	–	8.9	274	31
442	8	–	12	52	4.4
451	1	–	2.0	28	14
452	2	–	4.9	294	60
888[f]	2	–	76	1259	17
999[f]	32	–	146	19632	134
R8	1	–	4	11	2.5
R10	1	–	15	415	28

Table 39. Estimated Hours/Year that Involved the Use of Plant Materials used for Construction Practices

Zone	n[a]	Missing[b]	Population Size[c]	Estimated Annual Hours (hours/year)[d]	Annual Hours (hours/person/year)[e]
Local Area[g]	**85**	**–**	**535**	**83261**	**155**
UCR	**–**	**–**	**–**	**–**	**–**
% From UCR[h]	**–**	**–**	**–**	**–**	**–**

[a]Number of survey participants who reported using indicated resources.
[b]Number of survey participants with missing values for ET and/or EF.
[c]Estimated number of members of the CCT population who use the indicated source.
[d]Estimated hours/year, where hours per year for each participant was calculated as ET (hours/day) × EF (days/year).
[e]Estimated hours calculated by dividing the total estimated hours by the estimated population size.
[f]Zone "999" was recorded by the interviewer when the participant knew the source was within the Local Area but could not recall or did not want to reveal the exact location.
[g]Includes all CCT resource zones (including UCR River Reaches R1–R6, Zone 888 and Zone 999).
[h]Estimated as total from UCR divided by total from the Local Area.

5.3.3 Sources of Uncertainty in Non-Dietary Exposure

5.3.3.1 In-Water EF Estimate Uncertainty

Responses provided by 16 participants (5 females, 11 males) to questions on the ReUP about the number of days engaged in subsistence activities in Local Area waters were identified as potential statistical outliers (approximately 2.9% of the sample and 1.8% of the population). As discussed in Section 4.3.4 and Appendix E, the potential effect of outliers on the estimates was evaluated using two alternate sampling weights for the potential outliers: 1.0 and the median of the sampling weights. With sample weights equal to 1.0 for potential outliers, the estimates of the mean decreased from 34 to 32 days/year (approximately a 6% decrease), while the estimate of the P95 decreased by 0.2% (P95 remained essentially unchanged at 91 days/year). Substituting the median sample weight for the 16 potential outliers produced estimates of the mean and P95 that were less than 1% lower than the original estimates. When evaluated for specific age-sex categories, the effect of the potential outliers were greater for males than females: with sample weights equal to 1.0 for potential outliers, estimates of the mean number of days per year for males varied from 7–13% lower, while for females, the estimated means were 1–4% less than the original estimates. With sample weights changed to the median weight for potential outliers, the estimates of the mean for males varied from 4% lower to 6% higher; for females, estimates of the mean changed by less than 1%.

The sampling weights for six participants who appeared in the data that were used to estimate the number of days engaged in subsistence activities in Local Area waters exceeded the median plus six interquartile ranges. The estimates were not sensitive to these large sampling weights. After trimming the sampling weights for the six participants (i.e., replacing their sampling weights with the median plus 6 interquartile range), estimates for the mean and P95 changed by less than 1%.

5.3.3.2 On-Land EF Estimate Uncertainty

Participants may not have reported the location of "on land" activities in a consistent manner. Respondents may have reported a river reach when they were on the banks of that reach, or they may

have reported the correct upland zone. Interviewers were coached to code upland zones for that question, but there are cases where this was not implemented consistently. The data were analyzed as reported.

Responses provided by 29 participants (10 females, 29 males) to questions on the ReUP about the number of days engaged in subsistence activities on land were identified as potential statistical outliers (approximately 4.9% of the sample and 4.7% of the population). The effects of the potential statistical outliers on the estimates were evaluated using the approach described in Section 4.3.4 and Appendix E. With sample weights changed to 1.0 for potential outliers, the estimates of the mean decreased from 18 to 16 days/year (approximately a 14% decrease), while the estimate of the P95 decreased from 62 to 47 days/year. Substituting the median sample weight for the 29 potential outliers produced estimates of the mean and P95 that were approximately 4.6% and 12% less than the original estimates, respectively. Because approximately 2/3 of the potential statistical outliers were males, the estimates for the males were affected more than the females.

The sampling weights for 10 participants who appeared in the data that were used to estimate the number of days engaged in subsistence activities on lands located within the Local Area exceeded the median plus six interquartile ranges. Estimates for the subsistence activities on land within the Local Area were not sensitive to these large sampling weights. After trimming the sampling weights for the 10 participants (i.e., replacing their sampling weights with the median plus six interquartile range), estimates for the mean and P95 changed by less than 1% or less.

6.0 RESOURCE AVOIDANCE

6.1 Overview

The Tribal Survey concluded with questions to assess resource avoidance in the UCR area. The resource avoidance data will be used in the Uncertainty Section of the Baseline Site-wide HHRA to qualitatively assess potential future risk, as described in Section 2.2.3 (Step 3 of the DQOs) of the Tribal Survey Work Plan (U.S. EPA, 2010). The wording of the questions was revised in February 2011 to "…make clear that we want to know if the participant is avoiding using the local resources or using them less than they would like to…" (Westat, 2011). The original versions of the questions were administered to approximately 440 participants (Westat, 2011). During the week of February 14, 2011, interviewers began to administer the revised version of the questions (Westat, 2011). Interviewers also attempted to obtain responses to the revised version of the questions by phone from the participants who provided responses to the original version of the question.

Originally, Question 87 asked if the subject *refrained* from consuming plants, fish, or other animals from the UCR or Lake Roosevelt area or from using them for ceremonial, medicinal, or traditional uses. If a subject asked, "What do you mean by refrain?", the interviewer was prompted to explain that it meant "avoid or stop yourself from consuming or using natural resources." If the subject responded with "yes," then he/she was asked two more questions. Question 88 asked about the types of plants, fish, or other animals from the UCR or Lake Roosevelt area the subject *refrained* from using. Question 89 asked why the subject was not including these resources in her/his everyday diet and traditional practices.

Question 101 replaced "refrained" from Question 87 with "avoided" in an effort to improve understanding, asked if the subject *avoided* eating local fish, plants, or other animals; using local

resources; or hunting, swimming, fishing, or gathering plants in areas along the UCR or Lake Roosevelt. The interviewer was prompted to explain that "this would include avoiding these things altogether, or just doing them less than you would like to." If the subject responded with "yes," then she/he was asked two more questions. Question 102 replaced Question 88 and asked about the types of plants, fish, animals, or other local items or activities the subject *avoided or used less*. Question 103 replaced Question 89 and asked why the subject was avoiding the items or activities in Question 102. The subjects were given the following examples: living too far from the river or Lake Roosevelt area, being too busy, concerns about pollution, not knowing how to catch or prepare locally collected resources, or a preference for other foods or activities. These were open questions with no options to select from; however, a dropdown list was added to Question 103 for the interviewer to help code the subject's response. There was also space to record a subject's comments about Question 103.

Unfortunately, responses to the original questions cannot be analyzed because the number of the participants who were asked the original version of Question 87 is unknown (Westat, 2011). Without that information, it is not possible to estimate the frequency of responses to the original questions or to make comparisons between the two versions of the questions. Responses to the revised set of questions are summarized below.

Table 40 provides the response and estimated population frequencies for Question 101. The database includes responses to Question 101 for approximately 63% of the participants who completed the ReUP (approximately 60% of the population). Of those who provided responses to Question 101, approximately 37% responded "yes" and 63% responded "no" (less than 1% responded "I don't know").

Table 40. Resource Avoidance Data Summary and Population Estimates for Question 101

Avoid?	ReUP Age Group	Response Frequency	Population Frequency
Males			
Yes	14–17	8/24	46/139
	18–54	40/108	193/632
	55+	46/103	221/465
No	14–17	15/24	89/139
	18–54	67/108	436/632
	55+	56/103	241/465
Don't Know	14–17	1/24	3/139
	18–54	1/108	3/632
	55+	1/103	3/465
Females			
Yes	14–17	10/26	44/133
	18–54	57/150	311/920
	55+	61/141	219/536
No	14–17	16/26	89/133
	18–54	93/150	609/920
	55+	80/141	318/536
Don't Know	14–17	0/26	0/133
	18–54	0/150	0/920
	55+	0/141	0/536

Table 40. Resource Avoidance Data Summary and Population Estimates for Question 101

Avoid?	ReUP Age Group	Response Frequency	Population Frequency
Combined Sexes			
Yes	14–17	18/50	91/272
	18–54	97/258	504/1552
	55+	107/244	440/1001
No	14–17	31/50	178/272
	18–54	160/258	1045/1552
	55+	136/244	559/1001
Don't Know	14–17	1/50	3/272
	18–54	1/258	3/1552
	55+	1/244	3/1001

Participants who responded "yes" to Question 101 were asked Question 102 (types of resources or activities that were avoided or used less). Table 41 presents a summary of the responses to question 102. The percentages are based on participants who provided responses to question 102. Avoiding consumption of fish was the most common responses to Question 102 and approximately 13% of the participants reported avoiding or having reduced all of the activities listed in Table 41 .

Table 41. Resource Avoidance Data Summary for Tribal Survey Question 102

	All Resources[a]	Fishing	Swimming	Hunting	Gathering Plants
Number of participants (n = 212)[b]	28	201	69	50	44
Percentage of participants	13%	95%	33%	24%	21%

[a]All resources: participants who stated they avoided or used less of all of the resources or activities listed in this table (i.e. fishing, swimming, hunting and gathering plants).
[b]Of the 222 participants who indicated they avoided or used less of one or more resources (Table 40), the database did not include responses for 5 participants and 5 other participants indicated they did not interpret question 101 correctly.

6.2 Why Resources are Avoided

The most common responses to Question 103 refer to pollution in the UCR as the primary reason a subject avoided using local resources. Table 42 shows the response frequency and population frequency for the coded responses to Question 103.

Table 42. Response and Population Frequencies to Question 103 (Sexes Combined)

Coded Response[a]	Age Group (years)	Response Frequency[b]	Population Frequency[c]
Do not know how to use resources	14–17	0	0
	18–54	1	9
	55+	1	3
No desire to use resources	14–17	2	5
	18–54	7	45
	55+	6	35

Table 42. Response and Population Frequencies to Question 103 (Sexes Combined)

Coded Response[a]	Age Group (years)	Response Frequency[b]	Population Frequency[c]
Other reason	14–17	5	30
	18–54	8	47
	55+	30	131
Pollution/contamination	14–17	13	63
	18–54	78	383
	55+	75	291
Prefer other alternative	14–17	0	0
	18–54	9	42
	55+	8	40
Too busy	14–17	3	8
	18–54	6	54
	55+	5	28
Too far from UCR	14–17	0	0
	18–54	0	0
	55+	1	4

Note: Question 103 asked, "What are the reasons you avoid these items or activities, or use them less often than you would like to?"
[a]The responses that were listed in the questionnaire that the interviewer filled out based on how the participant responded.
[b]The number of participants who provided responses.
[c]Estimates of the number of people in the CCT population. Values were calculated by summing the sampling weights of the participants who provided responses.

7.0 SUMMARY AND CONCLUSIONS

7.1 Overview

Replacing national defaults with a large and comprehensive site-specific survey improves confidence and reduces uncertainties in the baseline HHRA. The Tribal Survey was designed to obtain CCT-specific data regarding use of the UCR Site by residents of the Colville Reservation, with the goals of informing the selection of exposure factors and reducing uncertainty in the estimation of exposure for this population in the HHRA. The major site-specific data needs stemming from the HHRA Work Plan for the Site (U.S. EPA, 2009) were:

- Information on soil, sediment, and surface water activities such as swimming, wading, boating, hiking, or camping that could be used to estimate frequency and duration of exposure to soil, sediment, and surface water in the Local Area.
- Information on soil, sediment, and surface water activities while hunting, fishing, gathering plants, root digging, gardening, and gathering other natural materials that could be used to estimate frequency and duration of exposure to soil, sediment, and surface water in the Local Area.
- Information regarding the frequency of fish consumption from the Local Area and the size of UCR fish meals consumed by residents of the Colville Reservation and their families to support estimates of UCR fish consumption rates.
- Information regarding the frequency of consumption of upland game, birds, shellfish, livestock, and wild plants from the Local Area and the size of meals consumed by residents

of the Colville Reservation and their families to support estimates of consumption rates of these species.

In the absence of site-specific data, preliminary risk estimates in the HHRA Work Plan were derived using standard default exposure parameters (e.g., U.S. EPA, 1989, 1991, 1997) or based on professional judgment.

In the following sections, exposure factors estimated from the Tribal Survey data are compared to the exposure parameters used in the HHRA Work Plan (U.S. EPA, 2009). This comparison can inform completeness of exposure pathways that were identified in the HHRA Work Plan (U.S. EPA, 2009) or identify more appropriate site-specific values for parameter estimates. Considerations such as the representativeness of the populations surveyed and the uncertainty around exposure estimates will be discussed in greater detail in the baseline HHRA. Section 7.2 discusses the data available for the estimation of dietary exposure (i.e., consumption of freshwater finfish, shellfish, wild game and birds, wild plants, livestock, cultivated fruits and vegetables, and dairy [milk and eggs]; Section 7.3 discusses exposure to UCR surface water, sediment, and soil during recreational and tribal activities; Section 7.4 discusses spatial information derived from the Tribal Survey (for "in water," "on water," and "on land" activities); and Section 7.5 provides a brief conclusion.

7.2 Data Comparison: Exposure Factors for Dietary Sources

As described in the Tribal Survey Work Plan (U.S. EPA, 2010), collection of CCT-specific data on dietary exposures from the Local Area were sought to inform exposure estimates. The following sections discuss the data available from the Tribal Survey to inform this exposure pathway analysis and to form the basis for deriving HIF values for dietary sources of exposure. RME estimates from the HHRA Work Plan are also compared to potential exposure parameters estimated using the Tribal Survey data for each dietary exposure pathway when available.

7.2.1 Consumption of Freshwater Finfish

For the fish consumption exposure scenario, the exposure factor (grams of fish consumption/day) is based on those respondents who reported consuming freshwater finfish ("consumers only") as described in Section 5.2.2. Table 43 provides a comparison of the exposure parameters for fish consumption presented in the HHRA Work Plan (U.S. EPA, 2009) to those based on data from the Tribal Survey.

For exposure from freshwater finfish consumption, exposure parameters from the HHRA Work Plan were based on national survey information (U.S. EPA, 2002a, 2002b) and professional judgment. The Tribal Survey collected age-specific information on the consumption of fish harvested from the UCR. In general, using CCT-specific information reduces uncertainties in the baseline HHRA. The information obtained from the Tribal Survey on the amount of fish consumed per day and the percentage of finfish meals sourced from the Local Area is considered adequate to establish a complete pathway for this route of exposure and to provide site-specific parameter values for the age groups surveyed to support the next steps in the HHRA process.

Table 43. Comparison of Exposure Parameters for Consumption of Freshwater Finfish from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey (MWL, 2016)

Exposure Factor	HHRA Work Plan[a,b]	Tribal Survey			
		Age Groups (years)			
		0–17 Males/Females	18+ Females	18+ Males	All Ages
Percentage sourced from the Local Area[c] (%)	50	73	65	71	69
Average (and P95) for grams of finfish consumed per day	280 (adults) 70 (children)	1.9 (4.8)	7.0 (17.2)	13.9 (33.5)	8.3 (24.6)

[a]HHRA values shown are for the Modern Subsistence Population.
[b]The HHRA Work Plan exposure factors for adults were based on the adult P95 value from U.S. EPA's *Exposure Factors Handbook* (U.S. EPA, 1997) and for children were based on the child P95, consumers and non-consumers based on 1991–1992 study by Columbia River Inter-Tribal Fish Commission (see U.S. EPA, 2009 for details). The location estimates assumed that 50% of freshwater finfish were derived from the UCR.
[c]The values shown are from Table 8; they represent the proportion of the total freshwater finfish meals (or more precisely, the percentage of days that fish were obtained from the indicated source), not the percentage by mass of fish consumed.

7.2.2 Consumption of Shellfish and Other Aquatic Organisms

For the consumption of crayfish and mussels, daily frequency of consumption and meal size (grams/day) are derived as described in Section 5.2.3 (see Table 9). These data may be used to calculate a DCR for these organisms in the HHRA. In the HHRA Work Plan (U.S. EPA, 2009), RME consumption rates of 70 and 280 grams/day for child and adult modern subsistence residents, respectively, were used based on U.S. EPA (2002a, 2002b) in the absence of site-specific data. An estimate for the DCR requires sufficient data for the frequency of consumption as well as for the amount consumed on days that it is consumed.

Daily frequency of consumption and meal size for "other aquatic organisms" (see Table 9, Section 5.2.3) may be used to derive DCRs of amphibians and reptiles for the HHRA. Based on the data presented in Table 9, it is anticipated that the estimated RME consumption rates for both the child and adult will be lower than the consumption rates for shellfish presented in the HHRA Work Plan (U.S. EPA, 2009). These data may need to be supplemented with data from the literature.

7.2.3 Consumption of Wild Game, Upland Birds, and Waterfowl

For the consumption of wild game, the exposure factor (grams of wild game consumption/day) is based on those respondents who reported consuming venison ("consumers only") harvested from the Local Area as described in Section 5.2.4.1 (Table 11). Table 44 provides a comparison of the exposure parameter information for wild game consumption presented in the HHRA Work Plan (U.S. EPA, 2009) to the estimates of venison consumption presented in this report. In Table 44, the exposure factors from the HHRA Work Plan are for the consumption of wild game and waterfowl combined, while the values based on the Tribal Survey are for venison only.

Table 44. Comparison of Exposure Parameters for Consumption of Wild Game from the HHRA Work Plan (U.S. EPA, 2009) to Venison Consumption Rates from the Tribal Survey

Exposure Factor	HHRA Work Plan[a,b]	Tribal Survey
Percentage of wild game (venison) meals sourced from the Local Area[c] (%)	50	88 (adults) 93 (children)
Average (and P95) for grams of wild game (venison) consumed per day[d]	179 (adults) 70.5 (children)	12 (42) (adults) 3.8 (13) (children)

[a]The HHRA values shown are for the Modern Subsistence Population.

[b]The HHRA Work Plan exposure factors for wild game for adults were based on the adult P95 value from U.S. EPA's *Exposure Factors Handbook* (U.S. EPA, 1997); the values for children were based on professional judgment. The HHRA values assumed that one-half of all meat ingested is derived from wild game/waterfowl and one-quarter of all meat ingested is derived from livestock. Adults: Table 11-30, total meat intake RME P95 (5.1 g/kg-day) adjusted to a body weight of 70 kg. Children: Table 3-50, total meat intake RME P95 for children 3–5 years old (9.4 g/kg-day) adjusted to a body weight of 15 kg (see U.S. EPA, 2009 for details). The location estimates assumed that 50% of wild game/waterfowl were derived from the Local Area.

[c]Values were estimated with the FQ data; the estimate is the mean of the percentage of venison sourced from the Local Area. Approximately 88% of all venison meals consumed by adults and 93% of meals consumed by children (0–6 years of age) were prepared with venison from the Local Area. A substantial amount of deer was attributed to CCT Zones that are adjacent to the UCR (Appendix F). Approximately 33% of the reported venison consumed (by adults and children combined) was assigned to Zone 999. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location.

[d]Consumption values shown were calculated using the NCI method, and were obtained from Table 11 of Section 5.2. Estimates represent the mean (P95) of reported consumption of venison.

Exposure parameters for the consumption of wild game that appear in the HHRA Work Plan were based on national survey information (*Exposure Factors Handbook*, U.S. EPA, 1997) and professional judgment. The Tribal Survey collected information on the consumption of wild game harvested from the Local Area, for various age groups. Except for venison, the number of AMPMs that captured data on the size (grams) of meals that include game was insufficient to produce reliable estimates of DCRs for the CCT population. While the frequency of consumption data provided by the FQ is adequate, the AMPM did not capture enough meals to estimate meal sizes. The sample sizes available from the AMPM for wild game other than venison are as follows (males, females): bear (1, 0); elk (5, 3); and moose (4, 13) (see Table 10). Statistics of meal sizes for wild game other than venison are provided in Table 10; additional data on meal sizes for wild game other than venison, such as upland birds and waterfowl, are required to develop reliable estimates of the DCR for those species.

The AMPM did not capture meals that included upland birds; however, approximately 19% of survey participants who completed FQs reported eating wild upland birds. As shown in Table 13 (Section 5.2.4.2), almost 100% of upland birds were sourced from the Local Area. In the absence of meal size data for wild upland birds, site-specific (AMPM) data for market chicken meal size will be used, along with the frequency data from the FQ for upland birds, to derive DCRs of upland birds in the HHRA.

The AMPM captured only one wild waterfowl meal (wild goose). Additional data on meal sizes for waterfowl are required to develop reliable estimates of the DCR. Section 5.2.4.3 and Table 13 describe the exposure data available for waterfowl from the Tribal Survey. In the absence of meal size data for wild waterfowl, meal size data for chicken provided by the AMPM will be used, along with the frequency data provided by the FQ for waterfowl, to derive DCRs for waterfowl in the HHRA.

7.2.4 Consumption of Wild Plants

The exposure factor estimated for the consumption of wild plants (consumption rate in grams of aquatic and terrestrial wild plants consumed per day) will be based on those respondents who reported consumption of wild plants ("consumers only") harvested from the Local Area, as described in Section 5.2.8 (Appendix G). Based on the available sample sizes for consumers, only meal size data for huckleberries will likely be used to derive DCRs.

For exposure to COPCs from wild plant consumption, exposure parameters utilized in risk calculations in the HHRA Work Plan were based on national survey information for adults (U.S. EPA, 1997) and professional judgment. The HHRA Work Plan upper-bound values for adults and children (385 and 192.5 grams/day, respectively) were based on the following assumptions: 25% of plants consumed were from the Local Area, and half of the plants consumed were aquatic and half were terrestrial (based on professional judgment). U.S. EPA's *Exposure Factors Handbook* (U.S. EPA, 1997) was the basis of the adult value which assumed one-quarter of all fruits/vegetables are derived from crops and one-quarter is derived from gathered plants. The value for children was 50% of the adult estimate (see U.S. EPA, 2009 for details). The Tribal Survey collected age-specific information on consumption of wild plants harvested from the Local Area. The number of AMPMs that captured data on the size (grams) of meals that include wild plants was insufficient to produce reliable estimates of DCRs for the CCT population. The FQ data on frequency of consumption of wild plants is adequate to estimate frequencies for many of the cultural plant species of interest. Additional data on the meal sizes for wild plants (based on recipes) may be utilized to develop estimates of the DCRs for wild plants. If reliable Site-specific estimates cannot be developed, default ingestion rates for similar plant part types may be utilized.

7.2.5 Consumption of Livestock

For the livestock consumption exposure scenario, the values shown in Table 45 (grams of livestock per day) are based on those respondents who reported consuming livestock ("consumers only") as described in Section 5.2.5. Table 45 provides a comparison of the exposure parameter information for livestock consumption presented in the HHRA Work Plan (U.S. EPA, 2009) to those based on information presented in this report.

For exposure from livestock consumption, exposure parameters from the HHRA Work Plan were based on national survey information (U.S. EPA, 1997) and professional judgment. The Tribal Survey collected age-specific information on livestock consumption; however, this exposure parameter was not used in the preliminary risk estimates presented in the HHRA Work (U.S. EPA, 2009). The HHRA Work Plan preliminary risk estimates were based on beef uptake models for livestock that utilized water from the UCR Site. In general, using CCT-specific information reduces uncertainties in the baseline HHRA. The information from the Tribal Survey on percentage of livestock meals sourced from the Local Area and grams of livestock consumed per day is considered adequate to support the next steps in the HHRA process.

Table 45. Comparison of Exposure Parameters for Consumption of Livestock from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey

Exposure Factor	HHRA Work Plan[a,b]	Tribal Survey										
		Male Age Groups (years)				Female Age Groups (years)						
		0–6	7–17	18–54	55+	0–6	7–17	18–54	55+	Child[e]	Adult[e]	All Age and Sex Combined
Percentage of livestock meals sourced from the Local Area[c] (%)	No value	21	20	20	26	16	12	20	18	19	20	19
Average (and P95) for grams of livestock consumed per day[d]	89 (adults) 35 (children)	67 (110)	120 (190)	170 (260)	140 (220)	73 (120)	96 (150)	120 (190)	100 (170)	70 (120)	130 (220)	120 (210)

[a]HHRA values shown are for the Modern Subsistence Population.
[b]The HHRA Work Plan values for adults and children were based on the following assumptions: that one-half of all meat ingested is derived from wild game/waterfowl and one-quarter of all meat ingested is derived from livestock (all these were based on professional judgment). The HHRA Work Plan values for adults and children were based on U.S. EPA's *Exposure Factors Handbook* (U.S. EPA, 1997), Table 11-30, total meat intake RME P95 (5.1 g/kg-day) adjusted to a body weight of 70 kg. The value for children, Table 3-50, total meat intake RME P95 for children 3–5 years old (9.4 g/kg-day) adjusted to a body weight of 15 kg (see U.S. EPA, 2009 for details).
[c]Values were estimated with the FQ data; the estimate is the mean of the percentage of livestock sourced from the Local Area. As shown in Table 14, approximately 19% of all livestock was sourced from the Local Area; 12–26% for the age-sex categories included in the analysis (Table 14). Approximately 5% of the reported livestock consumed was assigned to Zone 999. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location.
[d]Consumption values shown were calculated using the NCI method, and were obtained from Table 14 of Section 5.2.4. Estimates represent the mean (P95) of reported consumption of livestock. Note the youngest age range for the consumption rate estimates are for 0–6 year olds. The consumption rate estimates are based on data provided by the 24-hour dietary recall (AMPM) which, unlike the FQ, includes data for children less than 2 years of age.
[e]Adults are defined as being 7 years and older; children are defined as being 0-6 years of age.

7.2.6 Consumption of Cultivated Fruit and Vegetable Crops Harvested

For the local crop consumption exposure scenario, the exposure factors (grams of fruit and vegetables consumed per day) are based on those respondents who reported consuming crops ("consumers only") as described in Section 5.2.7. Table 46 provides a comparison of the exposure parameter information for crop consumption presented in the HHRA Work Plan (U.S. EPA, 2009) to those based on information presented in this report.

Table 46. Comparison of Exposure Parameters for Consumption of Fruits and Vegetables from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey

Exposure Factor	HHRA Work Plan[a,b]	Tribal Survey										
		Male Age Groups (years)				Female Age Groups (years)						
		0–6	7–17	18–54	55+	0–6	7–17	18–54	55+	Child[e]	Adult[e]	All Age and Sex Combined
Percentage of fruits and vegetables meals sourced from the Local Area[c] (%)	50	37	38	41	39	37	45	42	43	37	42	41

Table 46. Comparison of Exposure Parameters for Consumption of Fruits and Vegetables from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey

Exposure Factor	HHRA Work Plan[a,b]	Tribal Survey										
		Male Age Groups (years)				Female Age Groups (years)						
		0–6	7–17	18–54	55+	0–6	7–17	18–54	55+	Child[e]	Adult[e]	All Age and Sex Combined
Average (and P95) for grams of fruits and vegetables consumed per day[d]	385 (adults) 192.5 (children)	400 (700)	490 (820)	520 (860)	560 (930)	390 (670)	470 (800)	500 (840)	490 (830)	400 (680)	510 (850)	500 (840)

[a]HHRA values shown are for the Modern Subsistence Population.

[b]The HHRA Work Plan values for adults were based on U.S. EPA's *Exposure Factors Handbook* (U.S. EPA, 1997) for adults and a 50% adjustment for children based on professional judgment. Assumed one-quarter of all fruits/vegetables are derived from crops and one-quarter is derived from gathered plants. Adult: Table 9-29, total fruit and vegetable intake RME P95 (12 g/kg-day + 10 g/kg-day) adjusted to a body weight of 70 kg (see U.S. EPA, 2009 for details).

[c]Values represent the mean of the percentage of cultivated fruits and vegetables sourced from the Local Area. The UCR was not identified as the source of any fruits or vegetables. As shown in Table 17 (see Section 5.2.7), approximately 41% of all fruits and vegetables were sourced from the Local Area; this varied from 37–45% for the age-sex categories included in the analysis (Table 17). Approximately 2% of the reported fruits and vegetables consumed were assigned to Zone 999. Zone 999 was recorded by the interviewer when the subject knew the location was within the Local Area but did not recall or did not want to reveal the exact location.

[d]Consumption values shown were calculated using the NCI method, and were obtained from Table 17 of Section 5.2.6. Estimates represent the mean (P95) of reported consumption of all fruit and vegetable types (combined). Note the youngest age range for the consumption rate estimates are for 0–6 year olds. The consumption rate estimates are based on data provided by the 24-hour dietary recall (AMPM) which, unlike the FQ, includes data for children less than 2 years of age.

[e]Adults are defined as being 7 years and older; children are defined as being 0-6 years of age.

For exposure from consumption of locally harvested crops, exposure parameters from the HHRA Work Plan were based on national survey information (U.S. EPA, 1997) and professional judgment. The Tribal Survey collected age-specific information on total fruit and vegetable consumption. A parameter for the fraction of total fruits and vegetables consumed from the UCR was not used in the preliminary risk estimates provided in the HHRA Work Plan (U.S. EPA, 2009). The percentage of fruits and vegetables derived from the Local Area was estimated at 41%, based on the FQ data. The information from the Tribal Survey on the daily consumption of fruits and vegetables harvested from the Local Area is considered adequate to support the next steps in the HHRA process.

7.2.7 Consumption of Dairy (Milk and Eggs)

For the dairy exposure scenario, the consumption of dairy (i.e., the sum of grams of eggs and milk consumed per day) is based on those respondents who reported consuming locally sourced dairy products ("consumers only") as described in Section 5.2.6. Table 47 provides a comparison of the exposure parameter information for dairy consumption presented in the HHRA Work Plan (U.S. EPA, 2009) to those based on information presented in this report.

Exposure parameters were not provided in the HHRA Work Plan for dairy consumption. The Tribal Survey collected age-specific information on the consumption of various dairy products. Using CCT survey data will tend to reduce uncertainties in the baseline HHRA. The information from the Tribal Survey on the fraction of dairy and chicken eggs sourced from the Local Area, and among the dairy and chicken eggs consumed per day, is considered adequate to support the next steps in the HHRA process.

Table 47. Comparison of Exposure Parameters for Consumption of Dairy Products and Eggs from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey

Exposure Factor	HHRA Work Plan[a]	Tribal Survey										
		Male Age Groups (years)				Female Age Groups (years)						All Age and Sex Combined
		0–6	7–17	18–54	55+	0–6	7–17	18–54	55+	Child[e]	Adult[e]	
Percentage of dairy products sourced from the Local Area[b] (%)	No value	11	1	6	4	5	5	3	3	8	4	4
Percentage of eggs sourced from the Local Area (%)	No value	17	9.1	15	13	15	11	9.4	14	16	12	13
Mean (and P95) for grams of dairy products consumed per day[d]	No value	420 (850)	350 (720)	260 (560)	230 (510)	330 (660)	350 (720)	200 (450)	230 (500)	370 (780)	250 (560)	270 (600)
Mean (and P95) for grams of eggs consumed per day[d]	No value	18 (43)	21 (48)	34 (77)	45 (97)	21 (49)	20 (48)	32 (72)	34 (75)	19 (46)	33 (76)	31 (74)

[a]The HHRA Work Plan did not provide estimates for exposure to dairy products.
[b]Includes milk that is found in creams and cheese (cow milk only).Values were estimated with the FQ data; the estimate is the mean percentage of dairy sourced from the Local Area. No dairy products were directly attributed to the UCR (River Reaches R1–R6) in the Tribal Survey. As shown in Table 15,approximately 4% of all dairy was sourced from the Local Area; this varied from approximately 1–11% for the age-sex categories included in the analysis.
[c]The mean percentage of chicken eggs sourced from the Local Area. As shown in Table 16,approximately 13% of all chicken eggs were sourced from the Local Area; this varied from approximately 9–17% for the age-sex categories included in the analysis
[d]Mean (P95) DCRs for dairy and eggs were estimated using the NCI method (Tables 15 and 16, respectively, in Section 5.2.5). Note the youngest age range for the consumption rate estimates are for 0–6 year olds. The consumption rate estimates are based on data provided by the 24-hour dietary recall (AMPM) which, unlike the FQ, includes data for children less than 2 years of age.
[e]Adults are defined as being 7 years and older; children are defined as being 0-6 years of age.

7.3 Data Comparison: Exposure Factors for Non-Dietary Pathways

The following sections discuss the data from the Tribal Survey that form the basis for deriving HIF values for non-dietary sources of exposure. To further evaluate the potential need for additional data collection, parameter values in the HIF table from the HHRA Work Plan and selected parameter values that were estimated with the Tribal Survey data are compared for each non-dietary exposure pathway.

7.3.1 Exposure Factors for Activities

Collection of CCT-specific data on exposures related to activities in the Local Area were sought to inform exposure estimates (U.S. EPA, 2010). Surface water activities include those exposures that occur during activities in and on the water. Soil and sediment exposure factors are related to activities on land where incidental ingestion may occur.

For each of the exposure pathways, Table 48 provides a comparison of the exposure factor value for time spent engaged in activities (hours/person/year) derived from the HHRA Work Plan (U.S. EPA, 2009) to the estimates based on Tribal Survey data (see Section 5.3.1 and Appendices E and F). For exposure to surface water, soil, and sediment during activities, exposure parameters from the HHRA Work Plan were based on professional judgment. The HHRA Work Plan (U.S. EPA, 2009) did not

provide an estimate for the annual time spent participating in "on water" activities. While CCT-specific data were not obtained on media-specific ingestion rates, the Tribal Survey collected information on CCT-specific EF and duration of activities that may lead to contact with media from the Local Area.

Table 48. Comparison of Average Hours per Year Individuals Spent Participating in Activities from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey

Exposure Factor[a]	HHRA Work Plan (hours/person/year)	Tribal Survey (hours/person/year)[b]							
		Local Area	Reach 1	Reach 2	Reach 3	Reach 4A	Reach 4B	Reach 5	Reach 6
"In water" activities	720[c]	134	14	42	94	65	59	56	61
"On water" activities	720[c]	170	0	0	108	80	110	56	65
"On land" activities	720[c]	355	252	252	0	119	138	37	78

[a]Average weighted hours per year divided by the number of respondents. The values used for adults and children under the modern subsistence scenario were based on professional judgment.
[b]Values are from Tables 20. "Local Area" includes UCR River Reaches R1–R6 and all CCT resources zones; "Reach" refers to the UCR river reach.
[c]The HHRA Work Plan RME value (the product of EF at UCR Site [180 days/year] * event time [4 hours/day]) for adults and children under the modern subsistence scenario was based on professional judgment.

The locations for approximately 9400 hours (2%) of the "in water" activity are not available (Zones 888 and 999) (Table 21). Approximately 2500 hours of "on water" activity was coded as Zone 888 or 999 (Table 24); this accounted for approximately 1% of the estimated total hours engaged in "on water" activities. The locations for approximately 59,400 hours (5%) of the "on land" activity are not available (Table 27). Despite these limitations, the information from the Tribal Survey on time spent participating in activities is considered adequate to support the next steps in the HHRA process.

7.3.2 Exposure Factors for Tribal Activities

Collection of CCT-specific data on exposures related to tribal activities using materials sourced from the Local Area were sought to inform exposure estimates (U.S. EPA, 2010). Table 49 provides a comparison of the estimated annual time spent (hours/person/year) derived from the HHRA Work Plan (U.S. EPA, 2009) to the estimates based on Tribal Survey data (see Section 5.3.2 and Appendices E and F) for each of the tribal exposure pathways that could lead to contact with environmental media from the UCR.

For exposure to natural materials during tribal activities, exposure parameters from the HHRA Work Plan were based on professional judgment or information from other sites. While CCT-specific data were not obtained on media-specific ingestion rates, the Tribal Survey collected information on CCT-specific EF and duration of tribal activities that may lead to contact with media from the Local Area. In general, using CCT-specific information reduces uncertainties in the baseline HHRA.

Table 49. Comparison of Average Hours per Year Individuals Spent Using Resources from the UCR for Tribal Activities from the HHRA Work Plan (U.S. EPA, 2009) and the Tribal Survey

Exposure Factor[a]	HHRA Work Plan (hours/person/year)	Tribal Survey (hours/person/year)						
		Reach 1	Reach 2	Reach 3	Reach 4A	Reach 4B	Reach 5	Reach 6
Weaving with animal materials	1440 (adults)[b] 720 (children)[b]	0	0	0	90	73	0	0
Weaving and carving with plant materials	1440 (adults)[b] 720 (children)[b]	55	0	0	43	200	0	14
Using sweat lodge[c]	730 (adults)[d] 91.25 (children)[d]	0	0	0	0	40	34	0
Face and body painting	No values[e]	0	0	0	0	15	0	0
Medicinal, spiritual, or tribal activities[f]	100 (adult and children)[g]	0	0	0	0	3.0	0	0
Dyeing/coloring[h]	No values[e]	0	0	0	0	0	2.5	0
Construction	No values[e]	0	0	0	0	0	0	0

[a]Average weighted hours per year divided by the number of respondents. Average hours per year spent engaged in tribal activity using resources from the UCR (i.e., River Reaches R1–R6).
[b]The HHRA Work Plan upper-bound values for adults and children shown are based on professional judgment, are in terms of hours per year spent (days per year * 8 hours/day) and assumed 100% of the materials were derived from the UCR.
[c]Weighted total hours per year divided by the estimated population size of those taking sweats while using water from the indicated reach of the UCR.
[d]The HHRA Work Plan upper-bound values for adults and children (the product of EF [365 days/year adults and children] * event time [2 hours/day adult and 0.25 hours/day children]) were based on sweat lodge information from surveys of users at other sites (Harper et al., 2002; U.S. EPA, 2005a; and heat stress tolerance for children (Anderson et al., 2000). It was assumed that 100% of the water was obtained from the UCR.
[e]The HHRA Work Plan did not provide exposure factor estimates for this activity.
[f]Average weighted days per year divided by the number of respondents multiplied by 24 hours per day (likely a conservative overestimate).
[g]The HHRA Work Plan upper-bound values for adults and children (the product of EF [50 days/year adult and children] * event time [2 hours/day adult and 2 hours/day children]) were based on professional judgment.

An estimated 59 hours/person/year spent weaving with animal materials was not attributed to a source (i.e., was assigned to Zone 888 or 999; Table 30). An estimated 138 hours/person/year of sweat lodge use was associated with the use of materials from unknown locations within the Local Area (Table 30). Mouthing frequencies were recorded for each material used for building sweat lodges, but frequencies were not reported for materials used during the sweat lodge activity. An estimated 10 hours/person/year that included face and body painting used materials from unknown sources. The location of plants used for medicinal and spiritual practices is not available for an estimated 1 hour/person annually of this practice (Table 31). An estimated 2.5 hours/person/year spent using animal material for construction used materials from sources that were not provided; for plant materials used in construction this increased to approximately 134 hours/person/year. The source for most of the materials used in tribal practices was provided, with the exception of the materials used for dyeing practices. At this time, the information from the Tribal Survey on time spent participating in tribal activities is considered adequate to support the next steps in the HHRA process.

7.4 Spatial Information Derived from the Tribal Survey

Collection of CCT-specific data on exposure locations within the Local Area were sought to inform exposure estimates (U.S. EPA, 2010). This is discussed in the following sections for the consumption of fish and contact with surface water, soil, and sediment.

7.4.1 Spatial Information for Fish Consumption Data

Daily fish consumption estimates are provided in Tables 4 and 8. Although on a consumption amount and frequency basis, most fish were sourced from outside of the Local Area, survey participants reported eating fish from all river reaches except Reach 2 (Appendix F). Within the UCR, the consumption frequency ranged from 0.3 to 0.6 days/person/year (e.g., 0.5 days/person/year is equivalent to eating fish once every 2 years [1/0.5 days/person/year]). The estimated number of people consuming fish from the UCR is highest in Reach 6 (442 people) and lowest in Reach 1 (3 people). Fish tissue data are available for each of the river reaches for estimating exposure point concentrations (EPCs; TAI, 2013). The spatial information from the Tribal Survey for fish consumption rates and sources is sufficient to proceed to the next steps in the HHRA process.

7.4.2 Spatial Information for Activities

The following sections discuss the data derived from the Tribal Survey that may be used to estimate the exposure to the UCR during activities in and on the water, by river reach. In addition, the sample locations for beach sediment (TAI, 2011), fish tissue (TAI, 2013), and surface water (TAI, 2010) are compared with spatial data from the Tribal Survey for each exposure pathway.

7.4.2.1 Spatial Information for "In Water" Activities

As described in the Tribal Survey Work Plan (U.S. EPA, 2010), collection of CCT-specific data on location of the exposures related to "in water" activities in the Local Area were sought to inform exposure estimates. Spatial data for exposure factors related to "in water" activities are presented in Figure 3.

The spatial information from the Tribal Survey of "in water" activities (Figure 3) shows that exposure occurs at all reaches of the UCR. Within the UCR, the two reaches where the greatest exposure from "in water" activities occurs are Reach 4B and Reach 6. These reaches of the UCR have a number of samples that provide EPC information for water at beaches and in the river from that reach. The spatial information from the Tribal Survey on exposure during "in water" activities is considered sufficient to support the next steps in the HHRA process.

7.4.2.2 Spatial Information for "On Water" Activities

As described in the Tribal Survey Work Plan (U.S. EPA, 2010), collection of CCT-specific data on the location of the exposures related to "on water" activities in the Local Area were sought to inform exposure estimates. Spatial data for exposure factors related to "on water" activities are presented in Figure 4.

The spatial information from the Tribal Survey of "on water" activities (Figure 4) shows that exposure occurs at five reaches in the UCR (Reaches 3, 4A, 4B, 5, and 6), with the highest rate in Reaches 3 and 4B, and the highest total hours occurring in Reach 4B. These reaches of the UCR

encompass a number of sample locations that provide EPCs for water exposures. Therefore, the spatial information from the Tribal Survey on exposure during "on water" activities is considered adequate to support the next steps in the HHRA process.

7.4.2.3 Spatial Information for Activities on Land

As described in the Tribal Survey Work Plan (U.S. EPA, 2010), collection of CCT-specific data on the location of the exposures related to "on land" activities in the Local Area were sought to inform exposure estimates. Spatial data for exposure factors related to "on land" activities are presented in Figure 5. The spatial information from the Tribal Survey of "on land" activities (Figure 5) shows that exposure occurs throughout the Local Area, although use is higher west and south of the UCR. Beach sediment concentration data are available along the UCR. Therefore, the spatial information from the Tribal Survey on exposure during "on land" activities is considered adequate to support the next steps in the HHRA process.

7.5 Conclusion

Exposure pathways for traditional and modern subsistence populations were evaluated in the HHRA Work Plan (U.S. EPA, 2009) for the UCR Site using default or professional judgment-based exposure parameters. Preliminary risk estimates in the HHRA Work Plan were at or above levels of potential concern in one or more reaches of the river for the following subsistence pathways: incidental ingestion of surface water; incidental ingestion and dermal contact with sediment/soil; inhalation of outdoor air; consumption of fish and game; consumption of plants, crops, and livestock; and tribal-specific exposure scenarios related to sweat lodge use, basket weaving, and food preparation/preservation activities. The Tribal Survey provided data to refine exposure parameters based on site-specific information and to re-evaluate the CSM. Based on the analysis of Tribal Survey data described in this report, data are sufficient to update the exposure pathway analysis and produce reliable, site-specific estimates of the exposure factors listed in Table 1. The Tribal Survey also provided enough data to develop reliable DCR estimates for the Residents of the Colville Reservation population. While data were gathered for multiple scenarios that include potential exposure to surface water, sediment/soil, and air during tribal activities and consumption of a large range of food items, some of these data may not be used in the HHRA.

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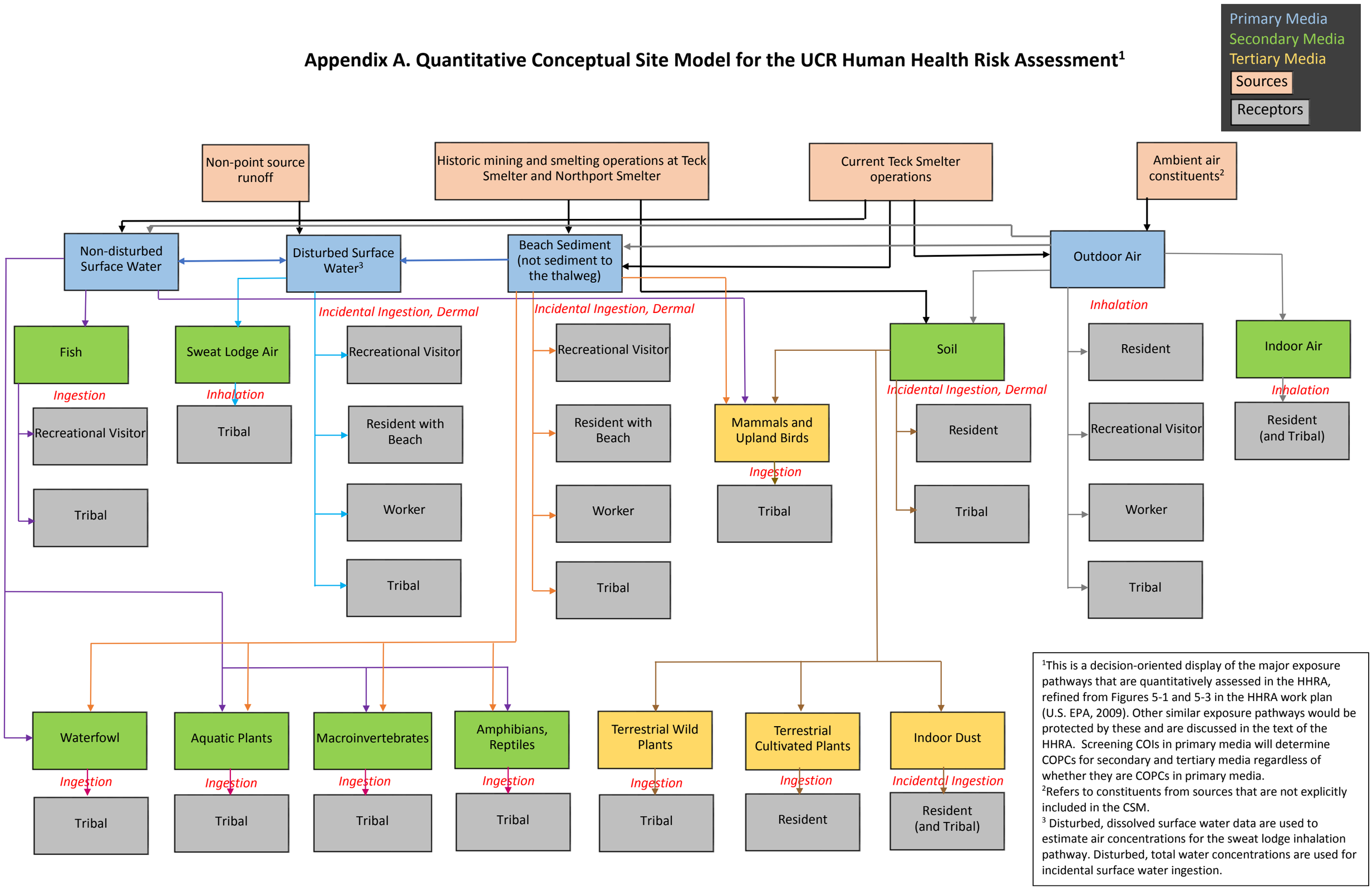
APPENDIX A.
CONCEPTUAL SITE MODEL

Appendix A. Quantitative Conceptual Site Model for the UCR Human Health Risk Assessment[1]



[1]This is a decision-oriented display of the major exposure pathways that are quantitatively assessed in the HHRA, refined from Figures 5-1 and 5-3 in the HHRA work plan (U.S. EPA, 2009). Other similar exposure pathways would be protected by these and are discussed in the text of the HHRA. Screening COIs in primary media will determine COPCs for secondary and tertiary media regardless of whether they are COPCs in primary media.

[2]Refers to constituents from sources that are not explicitly included in the CSM.

[3] Disturbed, dissolved surface water data are used to estimate air concentrations for the sweat lodge inhalation pathway. Disturbed, total water concentrations are used for incidental surface water ingestion.

APPENDIX B.
DIETARY SAS QUERIES

Appendix B
Summary of SAS queries for exposure from dietary sources

1.0 Introduction

This appendix provides a summary of the SAS queries that were used to create the data tables for analysis.

1.1 Freshwater Finfish

The AMPM fish consumption data analysis file was prepared by first querying the AMPM table for FCID codes that corresponded to finfish, shellfish and crustaceans (***FCID codes ('8000157000', '8000158000', '8000159000', 800160000, 8000161000, 8000162000***). Saltwater FCID codes were included because some freshwater species were coded as saltwater finfish. Species-specific data tables was were created one species at a time; the species-specific tables were then appended to form the freshwater finfish data table. All species-specific tables were created using the same approach: The where statements pulled all records that included one of the above FCID codes AND included the common name of the fish species in the ***Food_Desc*** field OR in the ***UCRRS_modDesc*** field.

1.2 Wild game/waterfowl, by type

The primary data files used were the ampm_ana_a tables and the fq_a tables. Records were selected by first querying the AMPM table for "game, meat" (FCID code = 3,800,221,000). The records returned by this first query were reviewed. Wild waterfowl was not included in the results of this query. The USDA Food_Description was then queried for "Goose, wild, roasted" to pull out records of wild waterfowl. Wild geese were the only waterfowl consumed by participants of this survey that were obtained from the wild. Records were placed into one of the following food item classifications: wild bear, wild elk, wild goose, wild moose, and wild venison. For each food item classification, the number of people consuming the item and the number of people consuming the item two or more days (during the survey period) were tallied.

For each food item, the intake was calculated by multiplying the 'portion_size_grams' field by the 'gramsDiv100' field. The total daily intake of each food item was determined for each of the survey participants' recalls. Next, the average (total) daily intake for each food item was calculated for each of the survey participants (i.e., the average of the total intakes from each of their dietary recalls). The population estimates of the mean, standard deviation and coefficient of variation of the daily intakes for each of the food items were then calculated using the average total intakes for each participant and their sampling weights.

1.3 Livestock

The primary data files used were the ampm_ana_a tables and the fq_a tables. Records were selected by first querying the AMPM table for FCID descriptions that contain "beef", "chicken", "poultry", "goat", "sheep", "pork" or "turkey" (FCID codes between 3,100,000,000 and 3,599,999,999; between 3,900,000,000 and 3,599,999,999; and between 6,000,300,000 and

6,000,400,000). The records returned by this first query were reviewed. "Goose, wild, roasted" was included in the results of this query. An additional filter was added to the USDA Food_Description field to not include "Goose, wild, roasted". Records were placed into one of the following food item classifications: beef, chicken, duck, goat, lamb, pork and turkey. For each food item classification, the number of people consuming the item and the number of people consuming the item two or more days (during the survey period) were tallied.

For each food item, the intake was calculated by multiplying the 'portion_size_grams' field by the 'gramsDiv100' field. The total daily intake of each food item was determined for each of the survey participants' recalls. Next, the average (total) daily intake for each food item was calculated for each of the survey participants (i.e., the average of the total intakes from each of their dietary recalls). The population estimates of the mean, standard deviation and coefficient of variation of the daily intakes for each of the food items were then calculated using the average total intakes for each participant and their sampling weights.

1.4 Dairy Products

The primary data files used were the ampm_ana_a tables and the fq_a tables. Several records in the ampm_ana_a table that had "milk, human" listed under the USDA Food Description field did not have a FCID code or description. An updated ampm_ana_a table was created. The "milk, human" records were assigned the FCID Code of 3,700,222,501 and the FCID Description of "human milk".

Records were selected by querying the AMPM table for the following FCID descriptions: "milk, fat" (FCID Code = 3600222000), "milk, fat – babyfood/infant formula" (FCID Code = 3,600,222,001), "milk, nonfat solids" (FCID Code = 3600223000), "milk, nonfat solids – babyfood/infant formula" (FCID = 3,600,223,001), "milk, water" (FCID Code = 3,600,224,000), "milk, water – babyfood/infant formula" (FCID Code = 3,600,224,001), "milk, sugar (lactose) – babyfood/infant formula" (FCID Code = 3,600,225,001), "human milk" (FCID Code = 3,700,222,501), "Egg, whole" (FCID Code = 7,000,145,000), "Egg, whole – babyfood" (FCID Code = 7,000,145,001), "Egg, white" (FCID Code = 7,000,146,000), and "Egg, yolk" (FCID Code = 7,000,147,000). For each food item classification, the number of people consuming the item and the number of people consuming the item two or more days (during the survey period) were tallied.

For each food item, the intake was calculated by multiplying the 'portion_size_grams' field by the 'gramsDiv100' field. The total daily intake of each food item was determined for each of the survey participants' recalls. Next, the average (total) daily intake for each food item was calculated for each of the survey participants (i.e., the average of the total intakes from each of their dietary recalls). The population estimates of the mean, standard deviation and coefficient of variation of the daily intakes for each of the food items were then calculated using the average total intakes for each participant and their sampling weights.

1.5 Cultivated Fruits and Vegetables

The primary data files used were the ampm_ana_a tables and the fq_a tables. Several records in the ampm_ana_a table that were identified as a fruit or vegetable did not have a FCID code or description. An updated ampm_ana_a table was created with FCID codes and descriptions assigned to those that were missing based on their USDA Food Description. Records with a Food Description of "Pomegranate Juice" were assigned the FCID Code of 9500289000 and the FCID Description of "Pomegranate". Records with a Food Description of "White potato, raw, with or without peel (assume peel not eaten)" were assigned the FCID Code of 103,300,000 and the FCID Description of "Potato, tuber, w/o peel". Records with a Food Description of "Asparagus, raw" were assigned the FCID Code of 9,500,019,000 and the FCID Description of "Asparagus".

The USDA Food Coding Scheme identified fruits and vegetables with codes between 40,000,000 and 79,999,999 (Dry beans, peas, other legume, nuts and seeds were within the 40,000,000's; Grain products were within the 50,000,000's; Fruits were within the 60,000,000's and Vegetables were within 70,000,000's). These records were first queried from the updated ampm_ana_a table. Next, all wild plants were filtered out by selecting records that did not have "Huckleberry" in the FCID description, and did not have "Balsamroot", "Bitterroot", "White Camas", "Wild Raspberry", "Wild Potato" and "Wild Onion" in the UCRRS modification description field. Records referring to "Wild Blackberry" were also filtered out by selecting those that did not have the UCRRS modification code of 101468 ("Blackberries, cooked or canned, NS as to sweetened or unsweetened; sweetened, NS as to type of sweetener / UCRRS WILD BLACKBERRY") *and* did not have the FCID code of 130105500 ("Blackberry").
A table (Fruit-Veggie_Food_Category_Upload.xlsx; included in Appendix A) was then created in excel that assigned a Food Item and Food Category to each FCID description of the queried results. This table was imported into SAS Enterprise Guide and linked to the updated ampm_ana_a table to create the Food Item and Food Category Field within SAS Enterprise Guide. The Food Item field is a generalized version of the FCID description.

For each Food Item, the intake was calculated by multiplying the 'portion_size_grams' field by the 'gramsDiv100' field. The total daily intake of each food item was determined for each of the survey participants' recalls. Next, the average (total) daily intake for each food item was calculated for each of the survey participants (i.e., the average of the total intakes from each of their dietary recalls). The population estimates of the mean, standard deviation and coefficient of variation of the daily intakes for each of the food items were then calculated using the average total intakes for each participant and their sampling weights.

1.6 Wild Plants

The primary data files were the ampm_ana_a tables and the fq_a tables. Several records in the ampm_ana_a table that would be identified as a wild plant did not have a FCID code or description. An updated ampm_ana_a table was created with FCID codes and descriptions assigned to those that were missing based on their USDA Food Description. Records with a Food Description of "White potato, raw, with or without peel (assume peel not eaten)" were assigned the FCID Code of 103,300,000 and the FCID Description of "Potato, tuber, w/o peel". Records with a Food Description of "Celeriac, cooked" were assigned the FCID Code of

101084000 and the FCID Description of "Celeriac". Records with a Food Description of "Asparagus, raw" were assigned the FCID Code of 9,500,019,000 and the FCID Description of "Asparagus".

The USDA Food Coding Scheme identified fruits and vegetables codes between 40,000,000 and 79,999,999 (Dry beans, peas, other legume, nuts and seeds were within the 40,000,000's; Grain products were within the 50,000,000's; Fruits were within the 60,000,000's and Vegetables were within 70,000,000's). These records were first queried from the updated ampm_ana_a table as wild plants were assumed to be found within them. Next, wild plants were filtered from the query by selecting records that had a FCID description of "Huckleberry", or had "Balsamroot", "Bitterroot", "White Camas", "Wild Raspberry", "Wild Potato" or "Wild Onion" in the UCRRS modification description field. Records referring to UCR Carrot and Cauliflower were filtered from the query by selecting records that had a UCRRS_modCode equal to 101425 ("Carrot"), 101426 ("Cauliflower") or 101427 ("Cauliflower"). Records referring to "Wild Blackberry" were selected by querying for those that had the UCRRS modification code of 101468 ("Blackberries, cooked or canned, NS as to sweetened or unsweetened; sweetened, NS as to type of sweetener / UCRRS WILD BLACKBERRY") *and* had the FCID code of 130105500 ("Blackberry"). Records referring to "UCR Blueberries" were selected by querying for those that had the UCRRS modification code of 101446 ("Pancakes, with fruit/UCRRS W/ Local Fruit") *and* had the FCID code of 1302057000 ("UCR Blueberry"). Records referring to "UCR Green Beans" were selected by querying for those that had the UCRRS modification code of 101437 ("Beans, string, green, cooked, from fresh, fat added in cooking w/ animal fat or meat drippings/UCRRS Grean Beans") *and* had the FCID code of 601043000 ("Bean, snap, succulent").

Records were placed into one of the following food item classifications: Balsamroot, Bitterroot, Huckleberry, Lomatium, UCR Carrot, UCR Cauliflower, UCR Green Bean, Wild Blackberry, Wild Onion, Wild Potato and Wild Raspberry. For each food item classification, the number of people consuming the item and the number of people consuming the item two or more days (during the survey period) were tallied.

For each food item, the intake was calculated by multiplying the 'portion_size_grams' field by the 'gramsDiv100' field. The total daily intake of each food item was determined for each of the survey participants' recalls. Next, the average (total) daily intake for each food item was calculated for each of the survey participants (i.e., the average of the total intakes from each of their dietary recalls). The population estimates of the mean, standard deviation and coefficient of variation of the daily intakes for each of the food items were then calculated using the average total intakes for each participant and their sampling weights.

APPENDIX C.

FISH CONSUMPTION MEMO

12/14/17

To: Marilyn Gauthier
From: Nayak Polissar, Janet Tooze, Moni Neradilek

Dear Marilyn, this memo reports on work by Janet, Moni and Nayak carried out to develop rates of freshwater finfish consumption. In this memo we provide rates and methodology that we recommend be used for that purpose.

As you know, the data for this analysis had the challenge of just a small number of survey respondents (12 respondents) who had "multi-hits"—two or more AMPM days with freshwater finfish consumption. However, the data on these 12 respondents and the data from the other 898 respondents who also had AMPM days (but who had, at most, a single hit) enabled estimation of the mean and percentiles of freshwater finfish consumption for the target survey population using the NCI method (details below). An important feature of this analysis was that the input datafile of AMPM freshwater finfish consumption had been carefully updated by Bill Thayer (SRC).

The question raised by everyone, including us, was: how reliable are those NCI-method estimates? We have been able to address that by calculating 95% confidence intervals for the mean and percentile estimates, but some of the uncertainty can't be captured by confidence intervals and has to be put into words (below). These are cautions, or reservations, or caveats, if you will. Our conclusion is that these estimates are meaningful and can be used, but the very wide confidence intervals should be well noted, and the verbal cautions should be noted as well.

Our final key estimates and confidence intervals for freshwater finfish consumption are as follows, Table 1. The detailed methodology for the confidence intervals is provided in the appendix.

Table 1. Estimated consumption of freshwater finfish (g/day) for three age-gender groups and all groups combined. Mean and 90th and 95th percentiles (with 95% confidence intervals). CCT survey.

	0-17 M + F	*18+ F*	*18+ M*	*All*
mean	1.9 (0.4-5.1)	7.0 (4.1-10.6)	13.9 (8.3-21.5)	8.3 (5.5-11.1)
p90	3.7 (0.8-10.0)	13.5 (7.4-22.6)	26.7 (15.3-44.8)	18.5 (11.5-26.6)
p95	4.8 (1.0-14.2)	17.2 (8.8-32.7)	33.5 (18.1-62.3)	24.6 (14.5-38.9)

Based on the NCI method, uncorrelated model, using the 3-category age-gender variable as the only covariate . Confidence intervals calculated by the parametric bootstrap (see the appendix).

How we tested the freshwater finfish estimates.

In order to find out more about the potential bias of the NCI method when the number of multi-hits is small, we created a similarly limited dataset starting from the AMPM data on total fish consumption (all species of finfish and shellfish combined). That dataset (prepared by Bill Thayer) had 45 respondents with multi-hits—a much more robust dataset for the NCI method. Briefly, we simulated 1000 datasets (on total finfish consumption) that were sparse in the total-fish multi-hits. Each dataset was created by randomly generating 243 respondents from a theoretical model (based on the total fish consumption dataset). The choice of 243 respondents per simulation was calculated so that there would be an expected average of 12 respondents with multi-hits across the 1000 simulations. The value of 12 is the same as the 12 multi-hits observed in the freshwater finfish dataset. In the total fish simulations, the number of multi-hits varied, realistically, both above and below 12.

The results (in Appendix Table A1) show that the means of the estimates from the sparse datasets were very close to the estimates derived using the full total-fish dataset with its 45 multi-hits. For the major statistics (mean and 90^{th} and 95^{th} percentiles of consumption), the magnitude of the differences (between sparse and full dataset estimates) ranged from 1% to 9% of the 95% confidence interval width. Thus, having a sparse dataset in and of itself does not appear to inherently lead to a notable bias in estimation using the NCI method. This demonstration does not, however, prove that there is not a bias whenever the NCI method is run on datasets with few multi-hits, and the demonstration, while confidence-building, may not apply to other sparse datasets that may be encountered for various fish species or other foods.

We also tried several methods for producing confidence intervals. We found the parametric bootstrap, which is what we used, to be most desirable, since, to some extent, it overcame the limitation of only 12 double hits for confidence interval construction[1]. We used the parametric bootstrap in the way that it is used in general statistical practice. The details of the parametric bootstrap method are in the appendix.

An early exploration of the freshwater finfish analysis consisted of our attempt to do a sensitivity analysis for the NCI model results by varying the within-person-variance (or varying some NCI-method parameter) and noting the range of consumption estimates that occurred. We abandoned this approach because we could not realistically vary a single parameter (such as the within-person variance) in isolation. In addition, the confidence intervals are much more desirable than a sensitivity analysis, because the confidence intervals, ideally, present a plausible range of values for a specific estimate (such as a mean) with a calculable (95%) coverage.

Remaining uncertainty in the estimates—aside from the uncertainty described by the confidence intervals, arises from the roll that the following issues might be playing.

> With only 12 multi-hits we could not determine if the within-person variances are equal among the three age-gender groups which were used in the NCI-method modelling. The

[1] The nonparametric bootstrap involves re-sampling from observed data. The parametric bootstrap involves sampling from a distribution (or distributions) that are based on parameters and a model that are derived from the observations. We prefer the parametric bootstrap here, because the 12 multi-hits in the survey sample may not sufficiently represent the day-to-day variation in consumption of freshwater finfish. The fitted models used in the parametric bootstrap are likely to be more realistic in their representation of the variation of consumption.

children's group (ages 0-17) did not have any multi-hits; thus, the within person-variance could not be assessed within that demographic group. The very limited number of multi-hits in each of the other two age-gender groups (18+ male, 18+ female) was too small for a meaningful variance analysis. Thus, a within-person variance that is equal across all three groups is assumed, but it is neither confirmed nor contradicted.

The small number of multi-hits limited our ability to adjust for what are commonly termed as "nuisance effects"; these are potential effects on consumption which may need to be controlled, but, unlike age and gender, they are not of primary interest. The nuisance effects include the weekend-weekday difference in consumption and the interview sequence effect (the potential difference in average consumption among the 1st, 2nd, 3rd and 4th interview days). The NCI models with and without the nuisance variables gave very similar values for the key estimates of consumption (mean, 90th and 95th percentiles). We also found that NCI models with and without an adjustment for the frequency of consumption (as reported on the FFQ interview) provided very similar values for the estimates of consumption. Thus, the FFQ variable was not included in the NCI model. Analysis with a larger sample size (a hypothetical thought exercise) might show value in including one or more of the frequency, weekend-weekday or sequence variables. However, the existing analysis with the available sample size did not demonstrate a need for them.

The models with and without correlation provided very similar estimates of consumption rates. The potential correlation occurs between the probability of freshwater finfish consumption on a randomly chosen day and the amount of freshwater finfish consumed on a consumption day. The correlation concept can be briefly stated for the freshwater finfish context: on the average, do more frequent eaters of freshwater finfish consume more of it on a consumption day than less frequent eaters consume on their consumption day? Equivalently, are frequency and amount related? We did not find evidence to require use of the correlated NCI model; therefore, the simpler and more easily computed model without correlation was used. A larger dataset would have provided a more thorough evaluation of potential correlation, but analysis of the existing data did not demonstrate a need for the correlation feature.

In conclusion, while the issues noted just above could have been addressed in a considerably larger dataset, we did not find any red flag that would prevent use of the consumption estimates provided here. Thus, despite the limitations noted, we feel that the estimates are useable and are a far better option for this project than providing no estimates of freshwater finfish consumption.

Appendix

Table A1. Comparison of total fish consumption estimates (g/day) by the NCI method using the full dataset (n = 910 respondents, see "Est. ..." column) and the mean of estimates using 1000 simulated sparse datasets (n = 243 respondents, see "Mean of simulations" column).

Consumption statistic	Est. fr NCI method (using full dataset)	Mean of simulations	SD of sim. distribution	Difference: sim. Mean minus est.	Diff. as % of width of symmetric, Z-BASED 95% CI[+]
mean	14.8	14.7	3.2	-0.1	-1%
p90	30	32	8.1	2	6%
p95	37.2	41.5	12.1	4.3	9%

[+]This descriptive statistic is intended to quantify the difference by scaling it using the width of a simple, symmetric 95% confidence interval. The quantity expressed is the difference expressed as a percentage of the full confidence interval width (= 2*1.96*SD).

Methods for the parametric bootstrap for freshwater finfish.
In general, the parametric bootstrap is a method for variance calculation (confidence intervals, standard errors). In the parametric bootstrap procedure, samples are drawn from the fitted model and the parameters of interest are re-estimated from the sample. The distribution of the re-estimated parameters across the samples (simulations) approximates the sampling distribution, with 2.5^{th} and 97.5^{th} percentiles of the re-estimated parameters representing the two-sided 95% confidence intervals for the parameters of interest.

In the analysis of freshwater finfish, the simulation also needs to take account of sampling (statistical weights, age-gender composition and the number of AMPM days per respondent). Here are the specific simulation steps:

1. **Fit the uncorrelated NCI model for freshwater finfish to the observed data.** Record all parameters from the mixtran macro (for use below).
2. **Calculate other required characteristics of the sample** (from the observed data)
    a. The number of respondents in the data set: N=910.
    b. The distribution of the number of AMPM days per respondent: 2.1% of respondents with 1 day, 43.6% of respondents with 2 days, 53.1% of respondents with 3 days and 1.2% of respondents with 4 days.
    c. Respondents' age-gender distribution: 25.8% children (0-17 years), 41.0% female adults (age 18+) and 33.2% male adults (age 18+).
3. **Simulate 1000 data sets from the NCI model**. In each simulation
    a. Generate the age-gender covariate for N=910 respondents by randomly drawing from the multinomial distribution described in 2c. Let I_BINA1 and I_BINA2 denote the adult male and children indicators (0=No, 1=Yes), respectively.

b. Assign each respondent a weight W by randomly permuting the statistical weights from the observed data.
c. Generate P_i, the respondent-specific probability of freshwater finfish consumption from the NCI model[2]: P_i = ilogit(P01_INTERCEPT + P02_BINA1*I_BINA1 + P03_BINA2*I_BINA2 + NORM(0, P_VAR_U1)). ilogit is the inverse logit function, P01_INTERCEPT is the probability intercept from the NCI model, P02_BINA1 and P03_BINA2 are the adult male and child probability coefficients from the NCI model, respectively, and NORM(0, P_VAR_U1) is a random draw from a normal distribution with a mean of 0 and variance P_VAR_U1. (P_VAR_U1 is the between-person random effect for the probability model.)
d. Generate A_i, the lambda-transformed respondent-specific freshwater finfish consumption mean on consumption days from the NCI model: P_i = A01_INTERCEPT+ A02_BINA1*I_BINA1 + A03_BINA2*I_BINA2 + NORM(0, A_VAR_U2), A_LAMBDA. A01_INTERCEPT is the amount intercept from the NCI model, A02_BINA1 and A03_BINA2 are the adult male and children amount coefficients from the NCI model, respectively, and NORM(0, A_VAR_U2) is a random draw from a normal distribution with a mean of 0 and variance A_VAR_U2. A_VAR_U2 is the between-person random effect for the amount model.
e. Generate N_i, the number of study days for every respondent i by randomly drawing from the multinomial distribution described in 2b.
f. Generate consumption indicators C_{ij} for the N_i study days of respondent i by randomly drawing N_i values from the binomial distribution with probability P_i.
g. If $C_{ij} = 0$ (for the i-th respondent's j-th day) then assign the consumption on day j to be $A_{ij} = 0$.
h. If $C_{ij} = 1$ then randomly generate the consumption on day j from the NCI model as A_{ij} = ilambda(NORM(A_i, A_VAR_E)). ilambda(x,lambda)= (lambda*x+1)^(1/lambda) is the inverse Box-Cox function and NORM(A_i, A_VAR_E) is a random draw from a normal distribution with a mean of A_i and variance A_VAR_E. (A_VAR_E is the within-person residual variance for the amount model.)
i. Save the simulated respondent indicators (with a set of values for every respondent, indexed by i), age-gender covariates (I_BINA1 and I_BINA2), weights (W) and daily consumptions (A_{ij}) to be used in the next step.

4. **Fit the NCI model to each of the 1,000 simulated data sets.** Then, for each simulation save the re-estimated parameters of interest (including mean, p90 and p95 of the usual consumption distribution—for each of the age-gender groups and for all respondents combined). If a) the NCI model fitting does not converge or b) there is a SAS warning that the Hessian matrix is not positive definite, reject the simulation run and continue adding simulations until 1000 simulations have been completed and not rejected.
5. **Calculate the 95% confidence intervals for each parameter of interest** as the 2.5^{th} and 97.5^{th} percentiles of the simulation distribution for each of the re-estimated parameters.

[2] The variable names are generally those that we used in fitting the NCI model.

APPENDIX D.

ALTERNATIVE NCI MODEL ESTIMATES FOR VENISON

Table D-1: summary of NCI models for estimation of long-term daily consumption rates for venison. Shaded column indicates the preferred model and estimates. The models summarized in the table below represent a larger list of models that were evaluated, which corresponded to combinations of the form of the daily frequency (FQ) data that were used as covariates (not transformed, log-transformed and no covariate), the method that was used to impute missing values for daily frequency (FQ imputation value) and NCI model type (correlated and not correlated). The models that did not include the FQ as a covariate were considered unreliable because the between-person variance parameter of the amount part of the models were considered too small, relative to the other models. The remaining 5 models all provide very similar estimates; however, Model D was used to estimate the distribution of venison DCR for adults since it had the lowest AIC.

FQ covariate form:	not transformed	not transformed	not transformed	Ln-transformed	Ln-transformed	no covariates	no covariates
FQ imputation value:	mean	mean	zero	mean	mean	-	-
NCI model type:	correlated	not correlated	correlated	correlated	not correlated	correlated	not correlated
	Model A	Model B	Model C	Model D	Model E	Model F	Model G
Mean	12	13	12	12	12	12	12
P90	28	29	28	29	28	33	28
P95	41	40	41	42	39	51	38
AIC *(lower is better)*	16721555	16735922	16735360	16545505	16552346	16779230	16853417
lambda	0.15	0.14	0.16	0.14	0.13	0.14	0.14
P_var_u1	1.0	0.85	1.0	0.78	0.76	2.1	1.2
A_var_u2	0.29	0.33	0.35	0.23	0.18	0.07	0.0003
A_var_E	3.0	2.6	3.2	2.7	2.5	3.1	2.9
Cov_u1u2	0.35	0	0.42	0.34	0	0.38	0

Mean: estimated mean long-term daily venison consumption rate (grams/day)

P90, P95: estimated 90th, 95th percentile of long-term daily venison consumption rate (grams/day)

AIC: Akaike information criterion (lower values are preferred)

Lambda: parameter for Box-Cox transformation (0=natural logarithm transformation)

P_var_u1: between person variance for probability model

A_var_u2: between person variance for amount model

A_var_E: residual model variance

Cov_u1u2: covariance between P_var_u1 and A_var_u2

APPENDIX E.

EXPOSURE FREQUENCY AND EXPOSURE TIME TABLES

(attached as compressed Microsoft Excel files:

Appendix E- ET_EF Tables.zip)

Data File Available on Request

APPENDIX F.

SPATIAL TABLES AND MAPS

(attached as compressed Microsoft Excel files:

AppF - Spatial Tables_Dietary_Water-Land.zip and

AppF - Spatial Tables_Traditional Practices.zip)

Data File Available on Request

APPENDIX G.

ESTIMATED CONSUMPTION FREQUENCIES FOR WILD PLANTS (TERRESTRIAL AND AQUATIC)

Appendix G: Estimated Consumption Frequencies for Wild Plants (Terrestrial and Aquatic)

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
Almond	adult	2	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	43%
	child	1	0.0833	0.0833	0.0833	0.0833	.	.	100%
	all consumers	3	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	47%
Apricot	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
BalsamRoot	adult	95	0.0620	0.0145	0.1095	0.2357	.	.	97%
	child	14	0.0585	0.0	0.1177	0.1709	.	.	100%
	all consumers	109	0.0617	0.0182	0.1052	0.2328	.	.	97%
Bearberry	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Bitterroot	adult	176	0.0294	0.0225	0.0363	0.0623	0.0395	0.0851	80%
	child	26	0.0182	0.0159	0.0204	0.0238	.	.	86%
	all consumers	202	0.0281	0.0220	0.0342	0.0553	0.0329	0.0778	81%
Black walnut	adult	3	0.0933	0.0754	0.1112	0.1252	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	3	0.0933	0.0754	0.1112	0.1252	.	.	100%
Blackberry	adult	148	0.0427	0.0283	0.0572	0.1107	0.0	0.2268	74%
	child	18	0.0307	0.0206	0.0408	0.0744	.	.	96%
	all consumers	166	0.0414	0.0285	0.0543	0.1067	0.0452	0.1682	76%
Buckbrush	adult	6	0.0208	0.0148	0.0268	0.0311	.	.	85%
	child	0	-	-	-	-	-	-	-
	all consumers	6	0.0208	0.0148	0.0268	0.0311	.	.	85%
Bunchberry	adult	2	0.0101	0.0028	0.0174	0.0154	.	.	38%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0101	0.0028	0.0174	0.0154	.	.	38%
Butterbur	adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Camas[c]	adult	152	0.0392	0.0255	0.0528	0.0718	0.0223	0.1213	76%
	child	30	0.0213	0.0172	0.0254	0.0339	.	.	91%
	all consumers	182	0.0368	0.0250	0.0486	0.0665	0.0332	0.0998	78%
Cattail	adult	9	0.0606	0.0044	0.1168	0.1665	.	.	100%
	child	2	0.0213	0.0136	0.0291	0.0303	.	.	100%
	all consumers	11	0.0542	0.0077	0.1007	0.0872	.	.	100%
Chamomile	adult	4	0.1847	0.0	0.4127	0.4798	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	4	0.1847	0.0	0.4127	0.4798	.	.	100%
Cherry	adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	child	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	all consumers	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Chive	adult	2	0.0591	0.0233	0.0950	0.0781	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0591	0.0233	0.0950	0.0781	.	.	100%
Chokecherry	adult	135	0.0398	0.0256	0.0541	0.0811	0.0010	0.1612	87%
	child	13	0.0292	0.0185	0.0399	0.0363	.	.	91%
	all consumers	148	0.0389	0.0259	0.0520	0.0817	0.0256	0.1378	88%
Comfrey	adult	2	0.1319	0.1142	0.1496	0.1403	.	.	92%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.1319	0.1142	0.1496	0.1403	.	.	92%
Dandelion	adult	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	child	0	-	-	-	-	-	-	-
	all consumers	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Elderberry	adult	64	0.0405	0.0199	0.0610	0.0817	0.0027	0.1607	85%
	child	9	0.0359	0.0212	0.0506	0.0766	.	.	88%

Appendix G: Estimated Consumption Frequencies for Wild Plants (Terrestrial and Aquatic)

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
	all consumers	73	0.0399	0.0217	0.0581	0.0799	0.0461	0.1138	86%
	adult	1	0.0333	0.0333	0.0333	0.0333	.	.	100%
Fir bough	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0333	0.0333	0.0333	0.0333	.	.	100%
	adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Gooseberry	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	adult	1	0.5714	0.5714	0.5714	0.5714	.	.	100%
Grape	child	0	-	-	-	-	-	-	-
	all consumers	1	0.5714	0.5714	0.5714	0.5714	.	.	100%
	adult	13	0.0554	0.0194	0.0913	0.1294	.	.	99%
Hawthorn	child	1	0.1429	0.1429	0.1429	0.1429	.	.	100%
	all consumers	14	0.0579	0.0230	0.0927	0.1306	.	.	99%
	adult	34	0.0270	0.0176	0.0365	0.0675	.	.	34%
Hazelnut	child	1	0.0167	0.0167	0.0167	0.0167	.	.	49%
	all consumers	35	0.0267	0.0175	0.0358	0.0668	.	.	35%
	adult	3	0.3183	0.1720	0.4647	0.4041	.	.	75%
Honey	child	1	0.4286	0.4286	0.4286	0.4286	.	.	75%
	all consumers	4	0.3407	0.2190	0.4624	0.4064	.	.	75%
	adult	657	0.0417	0.0355	0.0480	0.1429	0.1106	0.1751	83%
Huckleberry	child	113	0.0430	0.0307	0.0554	0.1075	0.0489	0.1661	88%
	all consumers	770	0.0419	0.0362	0.0476	0.1429	0.1111	0.1746	84%
	adult	7	0.0307	0.0273	0.0341	0.0323	.	.	100%
Huss huss	child	0	-	-	-	-	-	-	-
	all consumers	7	0.0307	0.0273	0.0341	0.0323	.	.	100%
	adult	1	1.0000	1.0000	1.0000	1.0000	.	.	100%
Hyssop	child	0	-	-	-	-	-	-	-
	all consumers	1	1.0000	1.0000	1.0000	1.0000	.	.	100%
	adult	115	0.0301	0.0154	0.0449	0.0524	0.0249	0.0799	84%
Indian Carrot	child	15	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	all consumers	130	0.0288	0.0155	0.0422	0.0478	0.0204	0.0753	86%
	adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Jumping Cactus	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Lavender	child	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	all consumers	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	adult	113	0.0380	0.0224	0.0536	0.0709	0.0167	0.1251	84%
Lomatiums[d]	child	12	0.0207	0.0166	0.0248	0.0299	.	.	100%
	all consumers	125	0.0363	0.0223	0.0504	0.0670	0.0134	0.1206	86%
	adult	2	0.0251	0.0155	0.0348	0.0317	.	.	100%
Mint	child	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	all consumers	3	0.0219	0.0147	0.0291	0.0306	.	.	100%
	adult	35	0.0218	0.0184	0.0253	0.0323	0.0249	0.0397	80%
Moss	child	1	0.0167	0.0167	0.0167	0.0167	.	.	49%
	all consumers	36	0.0217	0.0184	0.0250	0.0321	0.0247	0.0395	79%
	adult	3	0.1157	0.0717	0.1597	0.1349	.	.	100%
Mullein	child	0	-	-	-	-	-	-	-
	all consumers	3	0.1157	0.0717	0.1597	0.1349	.	.	100%
	adult	164	0.0320	0.0174	0.0467	0.0337	0.0	0.1239	92%
Mushroom	child	19	0.0180	0.0160	0.0200	0.0225	.	.	100%
	all consumers	183	0.0306	0.0174	0.0437	0.0322	0.0267	0.0377	93%
	adult	3	0.0616	0.0315	0.0918	0.0784	.	.	100%
Nettles	child	0	-	-	-	-	-	-	-
	all consumers	3	0.0616	0.0315	0.0918	0.0784	.	.	100%
	adult	31	0.0381	0.0174	0.0588	0.0546	.	.	93%

Appendix G: Estimated Consumption Frequencies for Wild Plants (Terrestrial and Aquatic)

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
OregonGrape	child	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	all consumers	33	0.0369	0.0173	0.0565	0.0504	.	.	93%
Parsley	adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
Peppermint	adult	2	0.0576	0.0208	0.0943	0.0779	.	.	100%
	child	1	0.0833	0.0833	0.0833	0.0833	.	.	100%
	all consumers	3	0.0664	0.0409	0.0918	0.0788	.	.	100%
Pine pitch	adult	1	0.0833	0.0833	0.0833	0.0833	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0833	0.0833	0.0833	0.0833	.	.	100%
Pine nut	adult	27	0.0420	0.0161	0.0680	0.1088	0.0	0.3716	36%
	child	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	39%
	all consumers	29	0.0405	0.0162	0.0648	0.1044	0.0	0.3612	36%
Princess pine	adult	1	0.0125	0.0125	0.0125	0.0125	.	.	75%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0125	0.0125	0.0125	0.0125	.	.	75%
Raspberry	adult	209	0.0267	0.0215	0.0319	0.0398	0.0092	0.0704	91%
	child	38	0.0253	0.0190	0.0317	0.0586	.	.	92%
	all consumers	247	0.0265	0.0219	0.0311	0.0448	0.0213	0.0684	91%
Rhubarb	adult	4	0.0264	0.0194	0.0334	0.0319	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	4	0.0264	0.0194	0.0334	0.0319	.	.	100%
Rosemary	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Sage	adult	45	0.0790	0.0278	0.1303	0.3413	.	.	66%
	child	0	-	-	-	-	-	-	-
	all consumers	45	0.0790	0.0278	0.1303	0.3413	.	.	65%
Sarvisberry	adult	154	0.0425	0.0245	0.0604	0.0680	0.0206	0.1155	89%
	child	13	0.0322	0.0181	0.0462	0.0705	.	.	83%
	all consumers	167	0.0418	0.0250	0.0586	0.0686	0.0422	0.0951	89%
Shooting star	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Soapberry	adult	46	0.0311	0.0127	0.0496	0.1118	.	.	79%
	child	6	0.0353	0.0063	0.0642	0.1000	.	.	73%
	all consumers	52	0.0314	0.0143	0.0486	0.1131	.	.	79%
Spring Beauty	adult	119	0.0319	0.0181	0.0457	0.0330	0.0223	0.0438	83%
	child	10	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	89%
	all consumers	129	0.0308	0.0180	0.0435	0.0317	0.0210	0.0423	84%
Stining Nettle	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Strawberry	adult	234	0.0233	0.0191	0.0275	0.0667	0.0146	0.1189	88%
	child	40	0.0302	0.0225	0.0379	0.0708	0.0429	0.0987	92%
	all consumers	274	0.0241	0.0203	0.0279	0.0706	0.0452	0.0960	89%
Sunflower Stem	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Tamarack	adult	2	0.0610	0.0265	0.0955	0.0783	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0610	0.0265	0.0955	0.0783	.	.	100%
Tamarack Tip	adult	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	child	0	-	-	-	-	-	-	-
	all consumers	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%

Appendix G: Estimated Consumption Frequencies for Wild Plants (Terrestrial and Aquatic)

Food Item[a]	Age Group[b]	Daily Frequency of Consumption (1/day)							Percentage Sourced from Local Area (%)
		n	Mean	LCL95	UCL95	P95	LTL95	UTL95	
Thimbleberry	adult	100	0.0212	0.0189	0.0235	0.0309	0.0259	0.0360	88%
	child	15	0.0203	0.0164	0.0242	0.0295	.	.	100%
	all consumers	115	0.0211	0.0190	0.0233	0.0308	0.0262	0.0353	89%
Twinberry	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Valerian	adult	11	0.1412	0.0026	0.2798	0.4688	.	.	82%
	child	0	-	-	-	-	-	-	-
	all consumers	11	0.1412	0.0026	0.2798	0.4688	.	.	82%
Walnut	adult	25	0.1670	0.0208	0.3132	0.8129	.	.	100%
	child	3	0.0442	0.0	0.0885	0.1140	.	.	100%
	all consumers	28	0.1591	0.0219	0.2962	0.7999	.	.	100%
Watercress	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Wild Camomile	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Wild Mint	adult	2	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	100%
	child	0	-	-	-	-	-	-	-
	all consumers	2	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	100%
Wild Onion	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Wild Sunflower	adult	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	child	0	-	-	-	-	-	-	-
	all consumers	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
Wild rose	adult	90	0.0620	0.0356	0.0885	0.1763	0.0	0.3951	86%
	child	9	0.0293	0.0130	0.0456	0.0684	.	.	100%
	all consumers	99	0.0596	0.0351	0.0840	0.1438	0.0	0.3623	87%
Yarrow	adult	2	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%
	child	1	0.0167	0.0167	0.0167	0.0167	.	.	100%
	all consumers	3	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	100%

LCL95, UCL95 = lower and upper 95% confidence limits for the mean; LTL95, UTL95 = lower and upper 95% tolerance limits for the P95.

[a]Estimates are based on wild plants sourced from the Local Area.

[b]Adults are defined as 7 years and older; children are defined as being 0-6 years of age.

[c]The source of this data is question 51 in the food questionnaire.

[d]The source of this data is question 45d in the food questionnaire.