

## 10. Intake of Fish and Shellfish

### 10.1 Introduction

Contaminated finfish and shellfish are potential sources of human exposure to toxic chemicals. Pollutants are carried in the surface waters, but also may be stored and accumulated in the sediments as a result of complex physical and chemical processes. Consequently, finfish and shellfish are exposed to these pollutants and may become sources of contaminated food. Accurately estimating exposure to toxic chemicals in fish requires information about the nature of the exposed population (i.e., general population, subsistence fishers) and their intake rates. Because the catch of recreational and subsistence fishermen is not “diluted” by fish from other water bodies, these individuals and their families represent the population that is most vulnerable to exposure by intake of contaminated fish from a specific location. Chapter 10 of the *Exposure Factors Handbook* provides recommended values for fish intake for the general population and recreational marine anglers. Highlights of Chapter 10 are presented here.

### 10.2 Recommended Exposure Factors

**General Population:** Recommendations for general population intake (presented in Table 10-1) are based on the U.S. EPA analysis of NHANES 2003-2006 data. The overall confidence in the recommendations is medium-high for the mean and low for the long-term upper percentiles.

**Recreational Marine Anglers:** The recommended values for recreational marine anglers are presented in Table 10-2. These values are based on the surveys of the National Marine Fisheries Service (NMFS, 1993). The overall confidence in these recommendations is low-medium for adults and low for children.

**Recreational Freshwater Anglers and Native American Fishers:** Recommended values are not provided for recreational freshwater anglers or Native American fishers because these data are limited to certain geographic areas and cannot be readily generalized to these populations as a whole; however, data from several relevant studies are provided in the *Exposure Factors Handbook* (see Sections 10.5

and 10.6). The following general observations can be made for freshwater recreational anglers: the range of average consumption for anglers from rivers, lakes, and ponds from Alabama, Connecticut, Indiana, Maine, Michigan, Minnesota, North Dakota, and Wisconsin varies from 5 to 51 g/day (includes all survey respondents); the consumption rate of fish from rivers in Georgia and Tennessee ranges from 20 to 70 g/day; and the consumption rate of fish from three lakes in Washington averages 10 g/day for adults. A summary of intake rates for Native American anglers is provided in Table 10-6 of the *Exposure Factors Handbook*.



**Table 10-1. Recommended Per Capita and Consumer-Only Values for Fish Intake (g/kg-day), Edible Portion, Uncooked<sup>a, b</sup>**

Age in Years	Per Capita				Consumers Only		
	N	% Consuming	Mean	95 <sup>th</sup> percentile	N	Mean	95 <sup>th</sup> percentile
<b>Finfish</b>							
All	16,783	23	0.16	1.1	3,204	0.73	2.2
Birth to 1 year	865	2.6	0.03	0.0 <sup>c</sup>	22	1.3	2.9 <sup>c</sup>
1 to <2 years	1,052	14	0.22	1.2 <sup>c</sup>	143	1.6	4.9 <sup>c</sup>
2 to <3 years	1,052	14	0.22	1.2 <sup>c</sup>	143	1.6	4.9 <sup>c</sup>
3 to <6 years	978	15	0.19	1.4	156	1.3	3.6 <sup>c</sup>
6 to <11 years	2,256	15	0.16	1.1	333	1.1	2.9 <sup>c</sup>
11 to <16 years	3,450	15	0.10	0.7	501	0.66	1.7
16 to <21 years	3,450	15	0.10	0.7	501	0.66	1.7
20 to <50 years	4,289	23	0.15	1.0	961	0.65	2.1
Females 13 to 49 years	4,103	22	0.14	0.9	793	0.62	1.8
50+ years	3,893	29	0.20	1.2	1,088	0.68	2.0
<b>Shellfish</b>							
All	16,783	11	0.06	0.4	1,563	0.57	1.9
Birth to 1 year	865	0.66	0.0	0.0 <sup>c</sup>	11	0.42	2.3 <sup>c</sup>
1 to <2 years	1,052	4.4	0.04	0.0 <sup>c</sup>	53	0.94	3.5 <sup>c</sup>
2 to <3 years	1,052	4.4	0.04	0.0 <sup>c</sup>	53	0.94	3.5 <sup>c</sup>
3 to <6 years	978	4.6	0.05	0.0	56	1.0	2.9 <sup>c</sup>
6 to <11 years	2,256	7.0	0.05	0.2	158	0.72	2.0 <sup>c</sup>
11 to <16 years	3,450	5.1	0.03	0.0	245	0.61	1.9
16 to <21 years	3,450	5.1	0.03	0.0	245	0.61	1.9
20 to <50 years	4,289	13	0.08	0.5	605	0.63	2.2
Females 13 to 49 years	4,103	11	0.06	0.3	474	0.53	1.8
50+ years	3,893	13	0.05	0.4	435	0.41	1.2
<b>Total Finfish and Shellfish</b>							
All	16,783	29	0.22	1.3	4,206	0.78	2.4
Birth to 1 year	865	3.1	0.04	0.0 <sup>c</sup>	30	1.2	2.9 <sup>c</sup>
1 to <2 years	1,052	17	0.26	1.6 <sup>c</sup>	183	1.5	5.9 <sup>c</sup>
2 to <3 years	1,052	17	0.26	1.6 <sup>c</sup>	183	1.5	5.9 <sup>c</sup>
3 to <6 years	978	18	0.24	1.6	196	1.3	3.6 <sup>c</sup>
6 to <11 years	2,256	22	0.21	1.4	461	0.99	2.7 <sup>c</sup>
11 to <16 years	3,450	18	0.13	1.0	685	0.69	1.8
16 to <21 years	3,450	18	0.13	1.0	685	0.69	1.8
20 to <50 years	4,289	31	0.23	1.3	1,332	0.76	2.5
Females 13 to 49 years	4,103	28	0.19	1.2	1,109	0.68	1.9
50+ years	3,893	36	0.25	1.4	1,319	0.71	2.1

<sup>a</sup> Analysis was conducted using slightly different childhood age groups than those recommended in *Guidance on Selecting Age Groups for Monitoring and Assessing Childhood Exposures to Environmental Contaminants* (U.S. EPA, 2005). Data were placed in the standardized age categories closest to those used in the analysis.

<sup>b</sup> For multiple percentiles, see Tables 10-7 through 10-12 in the *Exposure Factors Handbook*.

<sup>c</sup> Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

Source: U.S. EPA analysis of NHANES 2003-2006 data.

**Table 10-2. Recommended Values for Recreational Marine Fish Intake**

Age Group	Per Capita <sup>a</sup>	
	Mean (g/day)	95 <sup>th</sup> Percentile (g/day)
<b>Atlantic</b>		
3 to <6 years <sup>b</sup>	2.5	8.8
6 to <11 years <sup>b</sup>	2.5	8.6
11 to <16 years <sup>b</sup>	3.4	13
16 to <18 years <sup>b</sup>	2.8	6.6
>18 years	5.6	18
<b>Gulf</b>		
3 to <6 years <sup>b</sup>	3.2	13
6 to <11 years <sup>b</sup>	3.3	12
11 to <16 years <sup>b</sup>	4.4	18
16 to <18 years <sup>b</sup>	3.5	9.5
>18 years	7.2	26
<b>Pacific</b>		
3 to <6 years <sup>b</sup>	0.9	3.3
6 to <11 years <sup>b</sup>	0.9	3.2
11 to <16 years <sup>b</sup>	1.2	4.8
16 to <18 years <sup>b</sup>	1.0	2.5
>18 years	2.0	6.8

<sup>a</sup> Represents per capita values for recreational fishing population only. Data from U.S. EPA analysis of NMFS (1993) assumed to represent adults >18 years. Per capita values represent both survey individuals who ate recreational fish during the survey period and those that did not, but may eat recreationally caught fish during other periods.

<sup>b</sup> Recommendations for children were estimated based on the ratios of marine fish intake for general population children to that of adults using data from EPA's analysis of CSFII data (see Table 10-31 of the *Exposure Factors Handbook*), multiplied by the adult recreational marine fish intake rates for the Atlantic, Gulf, and Pacific regions, using data from NMFS (1993) (see Table 10-50 of the *Exposure Factors Handbook*). The ratios of each age group to adults >18 years were calculated separately for the means and 95<sup>th</sup> percentiles.

**For more information** about the key studies used to derive fish and shellfish intake values, refer to **Chapter 10 of the *Exposure Factors Handbook*** at <http://www.epa.gov/ncea/efh/pdfs/efh-chapter10.pdf>. Detailed information on fish intake studies among the general population is included in Section 10.3. Information on marine recreational studies is included in Section 10.4, and details of freshwater recreational studies are found in Section 10.5. Section 10.6 presents information about Native American studies of fish intake and Section 10.7 discusses other populations. Serving size studies are included in Section 10.8 and other factors to be considered for fish consumption (e.g., dry weight vs. wet weight) are discussed in Section 10.9.

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