



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

March 13, 1995

OFFICE OF
RESEARCH AND DEVELOPMENT

MEMORANDUM

SUBJECT: Review of ChemRisk January, 1995 Reports on the Hudson River Risk Assessment

FROM: Jackie Moya *Jackie*
Exposure Assessment Group (8603)

THRU: Kevin Garrahan, Chief
Exposure Assessment Applications Branch
Exposure Assessment Group (8603)

TO: Marian Olsen
Emergency Remedial Response Division
U.S. EPA Region 2

In response to your request dated February 16, 1995, I have reviewed the reports submitted by ChemRisk to Region 2 regarding the Hudson River Risk Assessment. Comments and questions are summarized below.

Page 2; Estimating Fish Consumption Rates for the Upper Hudson River: "Only a limited number of individuals near the Upper Hudson River are freshwater anglers."

Comment: What is this statement based on? The New York Statewide Survey reported 26,870 anglers in the Hudson River; 10,310 of those in the Upper Hudson River.

Page 2; Estimating Consumption Rates for the Upper Hudson River: ChemRisk stated that Barclay 1993 did not develop quantitative estimates of fish consumption rates.

Comment: Although Barclay did not provide fish consumption rates in terms of g/day, she provided an estimate of meals/week based on the survey responses, which can be translated into a consumption rate of approximately 30 g/day assuming a 0.5 lb serving size. One may argue that this number is based on the entire Hudson River and not just the upper portion of the river. However, fish consumption rates specific to the upper Hudson River cannot be obtained since a

fishing ban has been in place since 1976. In addition, there are fish advisories in place in other areas of the Hudson River which would argue for higher consumption rates if fish advisories were not in place. In addition, aren't there fish advisories in place in Maine?

Page 10; Estimating Fish Consumption Rates for the Upper Hudson River: ChemRisk claims that Maine consumption rates are applicable to Hudson River because the demographics of Maine anglers are similar to New York anglers and similarities in climate.

Comment: How similar are the rivers in Maine to the Hudson River? What specific factors are similar? Are the harvest data comparable? The number of anglers in the Hudson River were reported to be 26,870 in the New York Statewide Survey. In addition, according to the Maine survey, more anglers fish for coldwater species than warmwater species. 71% of anglers in New York fished for warmwater species. Hudson River anglers indicated that 38% of days they fished primarily for bass; 6.5% brown trout; 22.4% no specific type; 33.1% for other.

Page 11; Estimating Consumption Rates for the Upper Hudson River: "Hudson River anglers are likely to consume (in the absence of fishing restrictions) at rates corresponding to other water bodies with similar characteristics to the Hudson."

Comment: This statement ignores demographics of anglers. In addition, ChemRisk only established similarities in demographics between Maine and New York; similarities of water bodies have not been established. In addition, there are fish advisories in place in Maine and these data, although were part of the survey, were not presented in the ChemRisk 1991 report.

Page 2; Determining the Intake of Upper Hudson River Fish by Species: "In most cases, anglers preferentially fish for and consume species that have low lipid contents and which consequently accumulate lower levels of PCBs."

Comment: There are no data presented to support the statement that people prefer lower lipid content fish. ChemRisk should cite specific species. In general, lipid content is one factor which affect accumulation of PCBs. Trout, which is one of the species fished for in the Hudson River, has a 6% fat content; bass, 3% (USDA Agricultural Handbook No. 8). These species are not necessarily low fat when compare with other species. Salmon, although is not a species found in the Hudson River, but is a popular species fished for in other areas such as Maine, also has a high fat content (3 - 9% depending on the type). In addition, species that are bottom feeders are also likely to have higher PCB concentration than other species. Are any of the species found in the Hudson River bottom feeders?

Page 3 and 3a; Determining the Intake of Upper Hudson River Fish by Species: Fish species distribution for Hudson - like rivers and streams is presented by ChemRisk.

Comment: What was the criteria used to select these rivers and streams? NY survey presented data on species fished for by Hudson anglers and NY anglers in general. In addition, Barclay 1993 collected data on species found in the Hudson River. Why use other rivers and streams when data for the Hudson are available?

Page 5; Evaluating the Impact of Cooking Processes on the Level of PCBs in Fish: Preparation and cooking tend to reduce PCB concentrations.

Comment: Some data indicate reduction of PCB mass following some cooking methods while others show an increase in PCB mass. Since the creation of PCBs from cooking is unlikely, as it was stated in the ChemRisk report, this suggests that the hypothesis that PCBs are more extractable from cooked samples than from raw samples may be true. Therefore, this could mean that the concentration of PCBs in raw samples is underestimated and that may be PCBs from cooked samples are more bioavailable.

The reduction of PCB mass after cooking depends on the cooking method used. Some studies have indicated reduction after deep frying. In the questionnaire used by Barclay 1993 anglers were asked to provide information about preparation and cooking. Only the data from Connelly et al. 1992 was presented in the report (table 2). Has ChemRisk studied the data from Barclay 1993? These data may be used to provide some insight about preferred methods in the Hudson River area.

Finally, I would like to comment on the fish consumption values used in the dioxin reassessment document, which were mentioned during our conference call on March 9, 1995. In the document titled Estimating Exposure to Dioxin-Like Compounds Volume III: Site Specific Assessment Procedures, a fish consumption rate range of 1 -4 g/day was used. It is important to note, however, that these values are based on a hypothetical scenario. These scenarios were developed to demonstrate the methodology used for conducting site-specific assessments and are not intended to provide default values for exposure parameters. Volume II of the dioxin document addressess risks to subpopulations including recreational and subsistence fishermen. The values presented in Volume II are 30 g/day for a mean and 140 g/day for the high end, which are consistent with the Exposure Factors Handbook. For subsistence fishermen, 300 g/day was used.

Thank you for the opportunity to review these reports. We look forward to meeting with you on these issues. If you have any questions, please give me or Kevin a call at 202-260-2385 and 202-260-2588.

*Gradient Corporation***FACSIMILE MEMORANDUM p. 2****Key Issues to Discuss at the Meeting With GE**

- **PCB toxicity values**
 - Current reassessment of slope factor (To be discussed by EPA)
 - GE cancer studies
- **Fish consumption rate**
 - Total fish consumption rate - choice of most appropriate study
 - Impact of the fishing ban
 - Species-specific consumption rates
 - Variability for different ethnic groups
 - Availability of distribution of consumption rates
- **How to aggregate fish concentration data**
 - Based on migratory patterns of fish and distances people travel to fish
- **Exposure Duration**
 - County mobility rates
- **Cooking Losses**
 - Percent loss as a function of cooking method, lipid content, fish species
 - Distribution of preferences for cooking method
 - Ingestion of pan drippings

Questions Regarding the 4 ChemRisk/GE Exposure Parameter Papers**Determining the Intake of Upper Hudson River Fish by Species**

- (1.) According to this ChemRisk report, trout and salmon prefer faster, colder waters than the Hudson, and thus should not have been included in Table 3, Fish Species for Hudson-Like Rivers and Streams, because they would not be found in the Hudson. However, the selection method specifically screened for Hudson-like rivers and streams. Doesn't this fact instead suggest an error in the selection methodology, and that perhaps the entire distribution of fish species presented is of limited relevance to the Hudson?
- (2.) Of the meals eaten in Hudson-like rivers and streams, based on the Connelly data, 40.8% are trout and salmon species. Given that these species are not found in the Hudson, ChemRisk should provide the rationale for why these meals are all replaced with bass, as opposed to some other species or some combination of other species. This choice of bass seems arbitrary.
- (3.) What is the scientific basis for dividing the 19.1% "other" category evenly between meals of seven species of fish (bluegill, rock bass, pumpkinseed, black crappie, northern pike, chain pickerel, and yellow perch)? This choice seems arbitrary. Also if these species of fish are common in the Hudson but were not specifically included in the Connelly data set, and people in general like to eat them, is this not another reason why the Connelly data set is less appropriate to use in estimating species-specific intake rates for the Upper Hudson?
- (4.) Considering that 40.8% of the meals have been arbitrarily assigned to bass from trout and salmon, and that 19.1% of the meals have been arbitrarily assigned evenly to seven other species of fish, about 60% of the fish meals are estimated using correction factors and are not based on data collected in the Connelly data set. Does it really seem appropriate to use these correction factors on the data set?
- (5.) Based on ChemRisk 1992 survey of Maine freshwater anglers, of over 15 species caught and consumed, 3 species accounted for 85%. What were the three species?
- (6.) Please provide any available data which shows that the species of fish found in the Hudson are generally similar to the fish species commonly harvested in Maine.
- (7.) Please provide the calculations used to generate the values in Table 3.

Estimating Exposure Duration for Upper Hudson River Risk Assessment

- (1.) How readily available and usable is the county mobility data (from the US Bureau of Census)? Are mobility rates specific for the Upper Hudson region available?

Evaluating the Impact of Cooking Processes on the Level of PCBs in Fish

- (1.) Please provide any available data to indicate the extent to which people reuse or eat pan drippings after frying fish.

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- (2.) In comparing cooking preferences, frying and baking are clearly common methods. Please explain why there is such a significant difference between the Maine and New York data in preferences for poaching. Poaching is the preferred cooking method less than 1% of the time in Maine, while 61% of the New York anglers always, usually, or sometimes poach. Can this difference be entirely explained by the design of the New York study?
- (3.) Did the Connelly study only ask about four cooking methods (baking, frying, poaching, and soup)?
- (4.) Please explain why it is summarized, on pg. 405 of the 1993 Sherer and Price article, that microwave cooking may be relatively ineffective in removing lipids, while broiling or baking are more effective. The average percentage of reduction for all of these methods was about the same, 26, 27, and 22%.
- (5.) Are the reductions in cooking congener specific?

Estimating Fish Consumption Rates for the Upper Hudson River

- (1.) It is stated in Section 2 that the 1992 ChemRisk survey of freshwater anglers found that two-thirds did not consume the fish they caught. It is not clear as to which of the following is meant: (1) they *never* consumed the fish they caught, or (2) they *sometimes* ate the fish but *sometimes* threw them back. (Also, the 1992 ChemRisk reference is not included in the reference list.)
- (2.) "The majority of fish consumed by anglers are purchased and not self-caught (West et al., 1989)." Has this been more precisely quantified? This study is from Michigan; is this applicable to New York?
- (3.) Why is the 1993 Richardson and Currie study, from Table 1, not included in Table 2?
- (4.) Is it possible to look at a subset of any of the primary data sets, to meet more of the selection criteria?
- (5.) Is it possible to request the original data from the Connelly study, to generate a distribution even though the original study authors reported only a single point estimate?
- (6.) How comparable are the number and size of lakes and rivers in NY and ME? How comparable are the species of fish in the Hudson compared to Maine?

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TOTAL P.04

Table 4. Fish Species Distribution for Hudson River^a

Species	Percent Meals Eaten
American Eel	0.9
Bass	58.2
Bullhead	9.7
Walleye	7.5
White Perch	4.5
Bluegill	2.7
Rock bass	2.7
Pumpkinseed	2.7
Black Crappie	2.7
Northern Pike	2.7
Chain Pickerel	2.7
Yellow Perch	2.7

a. Based on Connelly et al. (1992) and NYSDEC (1990).

Fish Species Issues

- Chem-Risk Data - trout and salmon prefer faster, colder waters than the Hudson
? relevance to Hudson
- 40.8% of meals arbitrarily assigned to bass from trout and salmon
- 19.1% of meals arbitrarily assigned evenly to seven other species of fish
- 60% of fish meals estimated using correction factors
- Chem-Risk Data - 3 species accounted for 85% of fish caught
- Are the Hudson species similar to the Maine species

EXPOSURE DURATION

- Chem-Risk recommends assessing exposure duration for anglers based on 3 parameters
- Mobility - based on regional mobility, county mobility out of fishing area
- Angling Cessation - anglers lose interest, bad weather, increasing age, etc.
- Anglers - 72% of all licensed anglers fish each year once they start fishing
 - increases from 18 through 38
 - decreases in mid-40s to 60's
 - stable from 70 - 81
- Mortality - calculate life expectancy of angler

EXPOSURE DURATION - ISSUES

- Availability of data from Census
- Census definitions
- Census data available from 1990
- updates for 1995
- Addressing potential for people to
live in community for 70 years
or more
- Applicabilty of Maine data to Hudson

FISH CONSUMPTION RATES

- Recommend using the Chem-Risk Study of the Maine waters
- Impact of fishing ban on river
- Recommend using 1 g/day
- EPA used 30 g/day based on Puffer study and Pierce et al study in 1981 (surveys from California)
- NYSDEC Statewide Angler Survey showed average consumption of 45.2 meals/year, 227 g/meal or 28 g/day

Table 1. Fish Consumption Estimates for Recreational Anglers

Study	Consumption Rates (g/d)		
	Mean	Median	"High End"
All Commercial and Recreational Sources			
Fiore et al. (1989)	26	--	63 ^a
NYSDEC (1990)	28	--	--
West et al. (1989)	18.3	--	--
Marine - Self-Caught			
Landolt et al. (1985; 1987)	--	15 ^b	--
Pierce et al. (1981)	--	23	>54 ^a
Puffer et al. (1981)	--	37	339 ^a
Multiple Fresh Waterbodies			
Connelly et al. (1992)	6.8	--	32 ^c
Cox et al. (1985)	21.8	--	--
Cox et al. (1987)	19.4	7.5	--
Cox et al. (1990)	--	7.5	--
Ebert et al. (1993)	6.4	2.0	26 ^a
Fiore et al. (1989)	12.3	--	37.3 ^a
West et al. (1989)	7	--	--
Multiple Flowing Waterbodies			
Ebert et al. (1993)	3.7	0.99	12 ^a
Multiple Lakes and Ponds			
ChemRisk (1991a)	4.2	1.7	15 ^a
Richardson and Currie (1993)	16.2	--	--
Specific Waterbodies			
ChemRisk (1991b)	3.0	0.49	11 ^a
Soldat (1970)	1.8	--	--
Honstead et al. (1971)	7.7	--	--
Turcotte (1983)	7.4 ^d	--	--

a. 95th percentile.

b. Calculated using a Monte Carlo simulation based on frequency distributions provided by authors.

c. 92nd percentile.

d. Calculated based on 2.5 consumers per angler.

Table 3. Maine and NY Angler Demographics^a

Demographic Characteristic	New York ^b	Maine ^c
Mean Age	43	44
Sex (percent of respondents)		
Male	84.8	80.7
Female	15.2	19.3
Income Level (percent of respondents)		
<\$20,000	23.3	33.3
\$20,000 - \$49,999	49.9	51.9
>\$50,000	26.8	14.8
Education Level (percent of respondents)		
Grades 1 to 11	10.5	16.2
Graduated High School	32.3	32.5
Some College or Trade School	31.3	26.8
Graduate College or Trade School	13.1	18.6
Some Postgraduate	13.0	5.9

a. New York statistics include nonresident and resident anglers. Maine survey includes only resident anglers.

b. NYSDEC, 1990.

c. ChemRisk, 1991a.

Table 4. Distribution of Fish Consumption Rates for Moving Waters (Rivers and Streams)

Percentiles	Fish Consumption Rate
Minimum	0.001
5	0.11
10	0.17
15	0.23
20	0.28
25	0.35
30	0.46
35	0.59
40	0.71
45	0.83
50	0.99
55	1.2
60	1.4
65	1.7
70	2.1
75	2.5
80	3.2
85	4.3
90	6.1
95	12
Maximum	118
Median	0.99
Mean	3.7
StDev	12

Source: Ebert et al., 1993

FISH CONSUMPTION RATES - COMMENTS

- Impact of fishing ban
- Variability of consumption rates among different ethnic groups
- Availability of distribution of consumption rates
- Clarification of fish consumption in Maine
- Can a subset of data be used
- Comparability of number and size of lakes in Maine and New York - comparability of fish species

TOXICITY ISSUES

- RfDs available for Aroclor 1016 and 1254, Aroclor 1248 - inadequate data
- Slope factor for all PCBs under review
 - anticipate availability in draft this summer
 - requires peer-review
 - slope factor will be less
- GE rats sacrificed on 2/14/95
 - pathology evaluation under way
 - earliest anticipated availability of data in late 1995
 - Jim Cogliano will need to re-evaluate data upon receipt

Issues Overview

- Impact of Cooking on PCB Levels in Fish
- Species Intake
- Exposure Duration
- Fish Consumption Rates
- Risk Characterization (Monte Carlo)
- Slope Factors/RfD
- Draft Agenda
- Next Steps

NYSDEC Survey

- Long-term recall mail survey of NY anglers
- Recall of # of fish meals consumed over 1 year
- Found NY anglers consumed 28 g/day (32 g/day - 92 percentile)
- State-wide including lakes, etc.
- Purpose of study
 - level of knowledge of NYS anglers on health advisories
 - determine fishing behaviors and consumption patterns
 - advise on risk communication approaches
- No information on cooking practices

Maine Fishing Survey

- Freshwater Adult Licensed Anglers (1989/1990)
- Sample of 2,500 randomly selected Maine anglers
- Minimum number of responses 1,363 - 1,612 responded
- Respondents asked to report # of trips made to
ice fish, open-water fish in standing waters,
open-water fish in flowing waters
- Report on # of fish consumed for each of 15 groups
- Report on average length of fish consumed
- Specifically interested in TCDD levels
- Fish consumption rates 0.99 g/d - 2 g/d

CLEARWATER ANGLER SURVEY

- Detailed interviews with shore-based anglers intercepted as known fishing access sites in areas covered by health advisories and bans
- Excludes anglers fishing from boats, all river reaches and fishing at all possible times
- Conducted interviews with 336 anglers at 20 shorefront locations
- Interviews with 95% of anglers approached
- Found greater likelihood that people are fishing primarily for food, indicating subsistence consumption

DOH Recommendations to Reduce Exposures

- Choose fish from non-listed water bodies
- Choose fish species not listed on advisory
- Choose smaller fish within a species - older fish can have higher contaminant concentrations
- Remove skin and fatty portions along back, sides and belly of fish
- Select broiling, poaching, boiling and baking and allow fats to drain off (don't reuse fats).
- Pan frying not recommended.

Cooking - GE's position

- Cooking Volatilizes PCBs
- PCBs are separated from contaminated lipid in fish tissue based on higher temperatures and longer cooking time
- Majority of population prefers frying
- Anglers follow DOH warnings regarding trimming fish and discarding drippings

Comparison of New York and Maine Anglers

Cooking Method	New York Always	New York Sometimes	Maine
Baking	24	37	17.9
Boiling			0.2
Broiling			16.4
Frying	51.4	31	62.1
Poaching	24	37	0.9
Microwave			0.9
Raw			0.6
Soup	1.7	13	2.0

ISSUES REMAINING

- Use of pan drippings
- Different cooking preferences between Maine and New York anglers
- Are reductions congener specific?
- Inhalation risks while cooking
- Reliability of data used by Chem-Risk
(many of the studies were performed in 1970's and 1980's)
- Clearwater data - useful to analysis

Fish Species Intake

- 50 Fish Species in upper Hudson River
- Chem-Risk indicated that anglers preferentially consume species with less lipid content - less PCBs
- Chem-Risk 85% of fish caught represented by 3 species
- Percentage of other species
- Estimate of risks to anglers from fish consumption should include species preferences.

Table 3. Fish Species Distribution for Hudson - Like Rivers and Streams^a

Species	Percent Meals Eaten
American Eel	0.9
Bass	17.4
Brown Bullhead	9.2
Brown Trout	27.8
Carp	0
Channel Catfish	0.5
Chinook Salmon	1.4
Coho Salmon	1.8
Lake Trout	0
Rainbow Trout	9.8
Walleye	7.5
White Perch	4.5
Other	19.1

a. Connelly et al. (1992)

NYSDEC Survey

- Long-term recall mail survey of NY anglers
- Recall of # of fish meals consumed over 1 year
- Found NY anglers consumed 28 g/day (32 g/day - 92 percentile)
- State-wide including lakes, etc.
- Purpose of study
 - level of knowledge of NYS anglers on health advisories
 - determine fishing behaviors and consumption patterns
 - advise on risk communication approaches
- No information on cooking practices

MAINE SURVEY

- Primarily concerned with TCDD
- Focused on adult anglers with Maine License
- Surveys 2,500 anglers, needed 1,363 anglers
final numbers 1,612
- Respondent asked for info on disposition,
consumption of freshwater fish caught in Maine
- Anglers asked to estimate the average length
of fish consumed for each of 15 groups from
flowing and standing water bodies
- Asked for info on gift fish from others
- Fish consumption rates 0.99 to 2 g/day

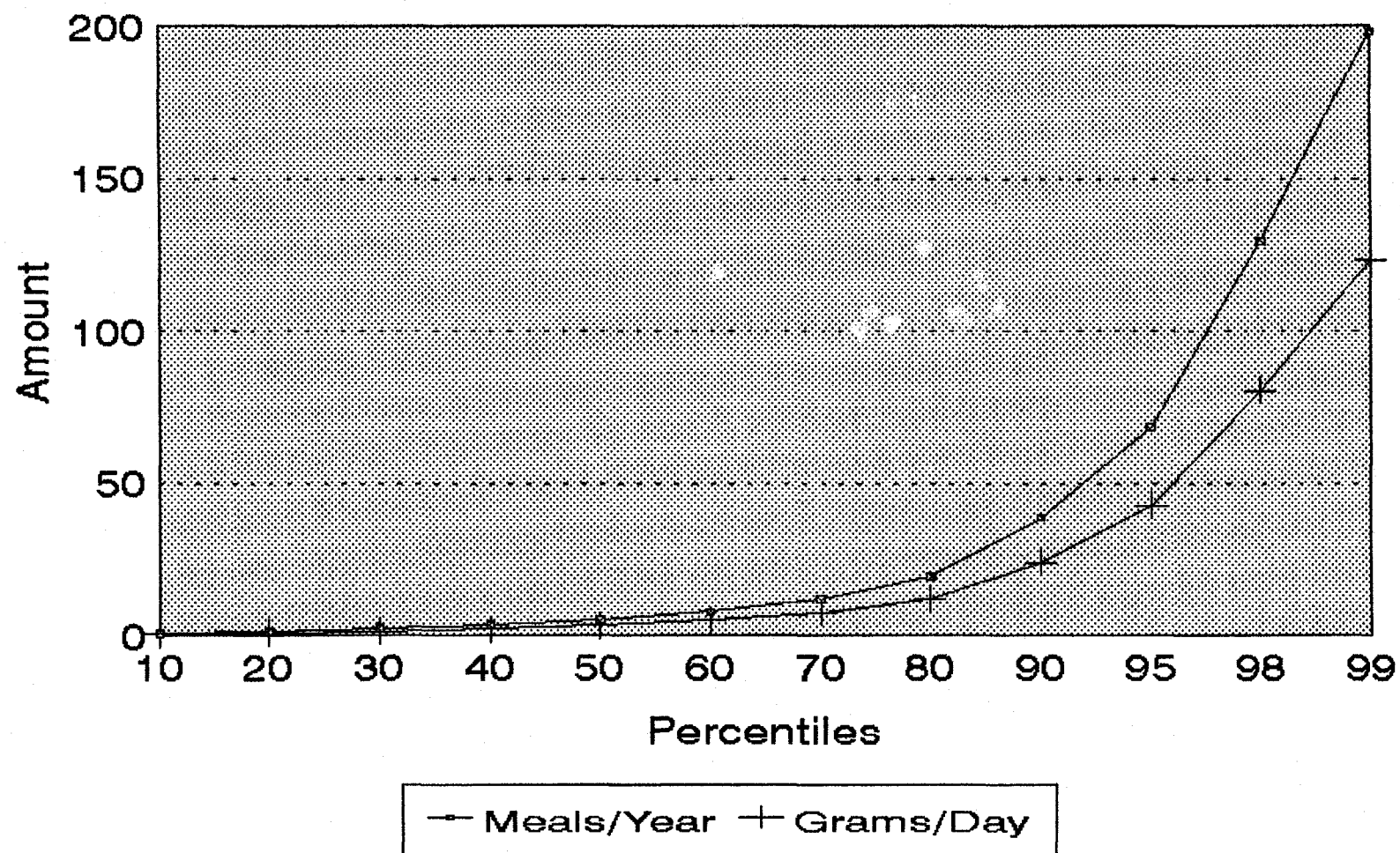
Comparison of New York and Maine Anglers

Cooking Method	New York Always	New York Sometimes	Maine
Baking	24	37	17.9
Boiling			0.2
Broiling			16.4
Frying	51.4	31	62.1
Poaching			0.9
Microwave			0.9
Raw			0.6
Soup	1.7	13	2.0

Calculation of RME

- Standard EPA Risk Equation
- Select Data Points from Distributions for:
 - Fish Concentration
 - Ingestion Rate
 - Exposure Frequency
 - Exposure Duration
 - Body Weight
 - % from Source
- Calculate Central Tendency, High End and Population

Fish Consumption Rates and Percentiles



Exposure Duration Statistics

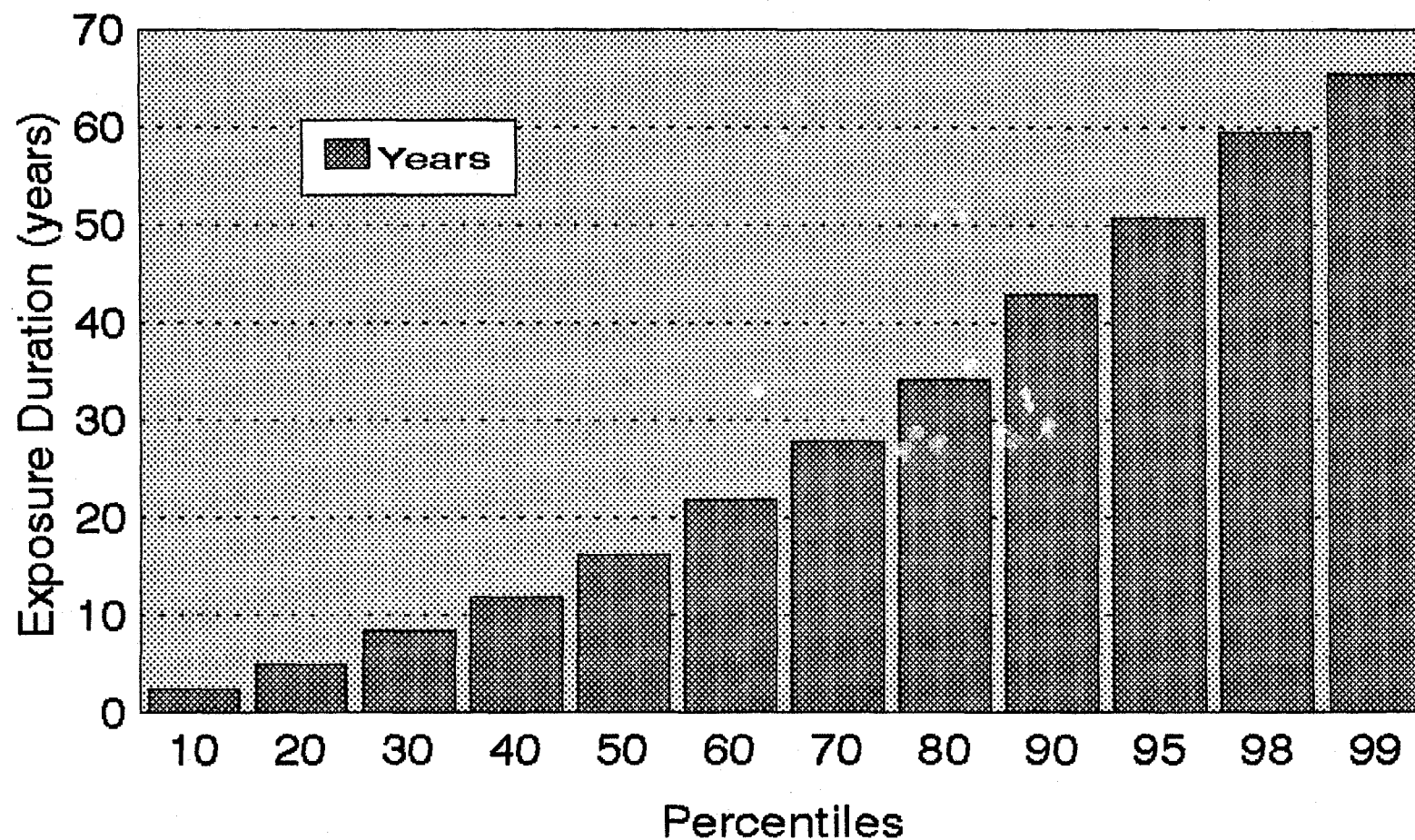


Figure 1.
Three Options for Defining the Exposed Population:
Exposure Durations for 3 Hypothetical Anglers

