Peer Review Report

Peer Review of
NCI Method Estimates of Usual Intake Distributions For Fish Consumption in Idaho

January 22, 2016

Peer Reviewers:

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Alanna J. Moshfegh, MS, RD
Janet A. Tooze, Ph.D., M.P.H.

DEQ Contract #K109

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I. INTRODUCTION

The National Cancer Institute (NCI) method was used in conjunction with the fish consumption survey data for Idaho general population and anglers (see "Idaho Fish Consumption Survey") to estimate usual intake distributions for fish consumption in Idaho. NCI was applied to the short-term dietary recall data with a reference period of 8 days. The results include usual intake distributions for two populations in Idaho – adult residents and adult resident anglers, for four (4) groupings of fish - all fish, Idaho fish, non-Idaho fish, and market fish. The results of this effort are summarized in the draft document "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho," authored by Information Management Services, Inc.(IMS). These data will be used by Idaho DEQ in deriving water quality criteria to be protective of human health. Additional background on the larger scope of Idaho DEQ's efforts can be found in the Overview section of Idaho DEQ's web site: http://www.deq.idaho.gov/58-0102-1201.

The purpose of this peer review was to have three experts evaluate the draft document "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho" with regards to the application of the NCI method to the dataset as well as the results of the analysis, including the calculation of fish consumption rates for all adult Idahoans and adult Idahoans who are anglers for fish of all types and source (All Fish) and for resident freshwater fish (Idaho fish).

Peer Reviewers:

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II. PEER REVIEW PROCESS

This section details the procedures that were followed to conduct this external peer review. Versar has a well-established approach for conducting peer reviews, from completion of more than 500 peer reviews of environmental risk assessment-related documents over the past 20 years for a variety of Federal and state government research and regulatory agencies. The approach covers all aspects of the peer review, from reviewer selection through completion of the peer review report. Within this approach are several quality assurance protocols to ensure that: qualified individuals are selected to participate, they are free from conflict of interest (COI) and the appearance of the lack of impartiality, and a thorough review is completed.

Reviewer Identification and Selection

Versar's approach for selecting the technical expert reviewers consisted of the following five key steps: (1) development of selection criteria, (2) identification of experts, (3) COI screening, (4) selection of peer reviewers, and (5) confirmation of peer reviewer participation.

The experts that participated in this review were identified by literature searches of scientific journals, professional societies, and scientific meetings, as well as searches of Versar's internal peer review database of more than 3,000 scientists. As a result of this search, Versar identified potential scientific experts with expertise in the general area fish consumption surveys. These experts were contacted to determine their availability and interest in participating in the review. Interested candidates provided their *curriculum vitae*, which were reviewed by Versar staff to ensure that each candidate had the appropriate scientific credentials and evidence of expertise through a listing of their publications and professional affiliations. The specific disciplines/areas of expertise needed for this peer review included: (1) fish consumption survey design and implementation, (2) computation of food consumption statistics from survey data collected using a food frequency questionnaire (FFQ) approach, and (3) statistical modeling of short term nutritional survey data to produce fish consumption statistics using the National Cancer Institute (NCI) method.

Versar also conducted COI screening to make certain that the experts had no COI or appearance of the lack of impartiality that would interfere with providing a thorough critical review of the document. This screening involved sending the potential candidates a series of COI screening questions that helped us to determine if they were involved with any other work and/or organizations that might create a real or perceived conflict of interest for the current task. Additionally, each expert signed forms certifying that, to the best of their knowledge, they did not have any conflict of interest related to the task. Upon completion of the COI screening, Versar selected three experts, based on their credentials, to conduct the review. Versar requested and received consent from the Idaho DEQ and, subsequently, contacted the three reviewers to notify them that they were selected to participate in the peer review.

Conducting the Review

Following the selection process, Versar distributed to the reviewers the draft document "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho" and a work assignment authorization (WAA) letter, which included the charge questions, instructions, and a

comment template for the preparation of written comments to ensure that each reviewer submitted their comments in a consistent format.

Versar developed a series of six charge questions to help guide and focus the review of the document. These charge questions generally asked reviewers to provide comments on the strengths, weaknesses, and overall quality of the study and report. The comment template instructed the reviewers to provide comments in the following three categories:

(1) General Impressions - overall comments addressing the accuracy of information presented, clarity of presentation, and soundness of conclusions.

(2) Response to Charge Questions - narrative responses to the six charge questions.

(3) Specific Observations - Specific observations or comments on the document, including editorial changes, mentioning page and line.

The WAA also included Versar's confidentiality statement indicating that the peer reviewers' should not distribute or discuss their comments with any outside party, as well as the amount of time the external reviewers had to complete their reviews and submit written comments. During the review period, Versar monitored the progress of the reviewers on a regular basis to make sure there was timely delivery of the written comments.

Review of Expert Comments

At the completion of the review period, Versar received written comments from the three reviewers, evaluated the experts' comments for completeness and scientific quality, and obtained clarification or additional input as needed. The three experts all submitted thorough reviews of the draft report, providing: (1) general comments, which included their overall impressions of the document, addressing the accuracy of information presented, clarity of presentation, and soundness of the conclusions; (2) responses to six charge questions; and (3) specific observations, which included editorial corrections or factual changes to the document. The comments were compiled into a peer review summary report, and organized by charge question to facilitate side-by-side viewing of the reviewers' comments on the same topics.

III. CHARGE TO REVIEWERS

Charge Questions:

1. Please comment on the clarity and organization of the report. Does it present information, including tables and figures, in a clear and usable format? If not, please provide suggestions for improving the clarity of the document, which is intended to be useful to state regulators, the scientific community, and other stakeholders, including the general public.
2. Please comment on the appropriateness of the application of the NCI technique to the fish consumption survey data available from the NWRG survey, based on short-term dietary recall with a reference period of 8 days, to develop usual intake distributions.
3. Please comment on the presented usual intake means for the populations of interest, Idaho adults and Idaho adult anglers, for all fish, Idaho fish, non-Idaho fish, and market fish. Do you have any comments on the reported 50^{th} and 95^{th} percentile intake rates?
4. Please comment on the analysis and differences in the usual intake means, estimated using the NCI method, to the weighted mean estimates directly from the recall data (without using the NCI method).
5. Are the results of the NCI analysis of usual intake rates scientifically sound and are the results for Idaho fish "valid" for use in derivation of water quality criteria to be protective of human health for the general population and recreational anglers?
6. Do you have any other suggestions for improving the scientific quality or utility of the document?

IV. GENERAL IMPRESSIONS

Patricia M. Guenther

The results are clearly presented; however, as described above (see peer review comments on "Idaho Fish Consumption Survey"), it seems possible that the recall data provided for these analyses represent a maximum of 2 days of intake data (not 7 or 8). If that is the case, the accuracy of the information in this report is highly doubtful.

Alanna J. Moshfegh

The accuracy of the data analysis conducted is sound as the individuals listed are known for conducting this type of analysis. The extensive list of tables in the report and in Appendix A provide a thorough statement and transparency of the analysis. The written parts of the report would greatly benefit from an editor.

Janet A. Tooze

This document was entirely focused on the data analysis of the recall surveys, and really did not provide any real discussion of the implications of the results. It would have been nice to see a little bit more discussion of the assumptions made in the analysis and the implications of the covariate adjustment used, particularly the body size, which is known to be associated with measurement error, and more specific details for each outcome (e.g., were all covariates used in all analyses?). It would have been helpful to have a discussion of using the full 8 days of recall vs. a smaller number of days, and also whether utilizing all 8 days with a sequence effect might have been preferable. In general, the method appeared to have been implemented correctly, but there are some points of clarification needed, particularly for Idaho fish.

V. RESPONSE TO CHARGE QUESTIONS

Charge Question 1
Please comment on the clarity and organization of the report. Does it present information, including tables and figures, in a clear and usable format? If not, please provide suggestions for improving the clarity of the document, which is intended to be useful to state regulators, the scientific community, and other stakeholders, including the general public.

Patricia M. Guenther

"Fish consumers" included in these analyses consumed fish at least once in the previous 7 days. Therefore, the inferred (target) population is adults who reside in Idaho and who consume fish at least once during any given week. It is not those who consume fish at all during a year as stated in the report. This inferred population is a smaller than the population who consume fish at all during a year, and their fish intakes are higher than those who consume any fish at all during a year. Therefore, the population estimates will be more conservative (i.e., higher) for the intended use than if "fish consumers" had been defined as those consuming fish at all during the past year. This needs to be clarified in the report.

The tables and graphs are clear, except for the graphs that include Non-Idaho Fish and Market Fish. The organization of the report is good, but too much of the information is repeated unnecessarily. Important information should be in both the summary and the body of the report, but nothing else needs to be stated more than once.

Alanna J. Moshfegh

Specific comments on the organization of the report and the numerous places where text is duplicated are detailed below. It seemed as if the authors were struggling to fill pages. The data presented in the tables are clear and the format is good.

Janet A. Tooze

I think the report is presented in a logical manner, and there are certainly a lot of tables and figures. The report itself is quite brief and of course could not stand on its own without the other report. It would actually be most useful if the two reports could be integrated and an overall summary could be drafted. There is a lot of analysis presented in this report with very little interpretation.

Charge Question 2
Please comment on the appropriateness of the application of the NCI technique to the fish consumption survey data available from the NWRG survey, based on short-term dietary recall with a reference period of 8 days, to develop usual intake distributions.

Patricia M. Guenther

It does not appear that the NCI method was appropriately applied. The approach taken seems to assume that 8-day recall includes *all* the fish that was consumed during the reference period, but that may not be the case. It appears that the data available include only the first day, which may or may not include fish, and only one other day, which does include fish. The second day was not chosen at random, but rather with certainty because it included fish. The survey did not determine on how many days fish was consumed during the reference period. This seems to undermine the sampling theory on which the NCI method relies. If somehow all of this does not matter, then why is does not matter should be explained. In any case, the amount reported for 8 days is actually only for a maximum of 2 days, so it cannot simply be divided by 8 to get a 1-day amount.

It is misleading to say that recalling intake over a period of up to 8 days is a "short-term" recall. It is shorter than a year or 30 days, which is the reference period for many food frequency instruments, but "short-term" recall is typically 1 day, not 8. The validity of the "8-day recall" method has not been established. It would be better to simply avoid the phrase "short-term" when describing the recall for this study.

Did the authors, IDEQ, or NCI consider the possibility of estimating the usual intake distributions from just the days reported during the first contact? If not, why not?

Alanna J. Moshfegh

Appropriate application as the authors are well-known for conducting this type of highly specialized analysis.

Janet A. Tooze

In general, dietary recalls tend to exhibit less systematic error than FFQs. Fish is considered an episodically consumed food, meaning that it is not consumed every day. In addition, fish consumption data are generally positively skewed, and there may be positive correlation between the probability of consuming fish and the amount consumed, i.e., those who eat fish more frequently may consume more fish on eating occasions. The NCI Method adjusts for random error, skewed data, episodically consumed foods, and the correlation between probability of consumption and amount. It also may incorporate covariates to adjust for sequence effects, and make estimates for certain population strata. Therefore, the NCI Method is appropriate to use for fish consumption estimates for this survey. However, it is important to note that for this particular implementation of the NCI method, consumption day probability and amount were not allowed to be correlated with each other, but were assumed to be independent. The report states this was due to "data limitations." It would be helpful to give further information on these "limitations." It may be without having consumption day level data that the correlation cannot be estimated as well as with using 24-hour recalls. Furthermore, the Box-Cox parameter was estimated outside the macro also due to "data limitations." This would not be anticipated to have a large impact on the results. In addition, the "sequence" effect was limited to comparing the two 8-day recalls, but there appear to be sequence effects within the 8-d recalls. It would be helpful to provide a discussion of the impact of these decisions on the results.

It is not clear why gender was not stratified by or included as a covariate in any analyses, particularly since there appear to be gender effects, and most national dietary intake data are stratified by gender.

It is also confusing that the report states that "models were fit separately for the angler and non-angler strata," but results are presented overall. Does this mean they were also run overall, or were the two strata combined? If not, how were anglers treated in the overall analysis? Obviously they have different rates of consumption of Idaho fish from non-anglers.

How were the per kg estimates calculated if body weight is included as a covariate?

The type of backtransformation used and how well data were transformed to normality should be addressed, particularly for the Idaho fish analyses.

Charge Question 3
Please comment on the presented usual intake means for the populations of interest, Idaho adults and Idaho adult anglers, for all fish, Idaho fish, non-Idaho fish, and market fish. Do you have any comments on the reported 50^{th} and 95^{th} percentile intake rates?

Patricia M. Guenther

The report would be more useful if an explanation would be offered for why the consumption rates of non-Idaho fish and of market fish separately are of interest.

The decision to analyze the data for anglers as a separate stratum seems to be based on the mistaken belief that that angler data were collected using a separate sampling frame. This decision should be re-visited. The original intent was to have a separate sampling frame, but it was not implemented as explained in the companion report:

"BSU [Boise State University] originally recommended that 2,000 of the 7,000 completed surveys should be completed with anglers. This recommendation was driven by the assumption that anglers would be more likely to consume fish and that an over-sample of anglers would be needed to achieve the necessary number of twice consumers [50] to use the NCI method. During the pretest and after the first six weeks of data collection, a review of the data indicated that approximately 33 percent of those contacted using the general population sample reported that they had a valid license. Therefore, a minimum number of interviews (n = 1,500 or 33 percent of all interviews) with the angler segment was established.

"It was originally believed that use of the list of current license holders would be the most efficient means to reach anglers. The list contained both landline and cell phone numbers, although these were not distinguished. The pretest and first month of data collection used both the RDD sample frame and the IDFW list. High contact and response rates via the IDFW list plus a high incidence of anglers in the RDD sample frame resulted in a significant over-representation of anglers. The decision was made to not use the IDFW list and rely only on the RDD sample frame. In addition to reducing the potential for significantly over-representing

anglers, sole use of the RDD sample frames eliminated any frame overlap between the RDD frames and the IDFW sample frame.

"A total of 1,649 anglers were interviewed. Relying on the review of the IDFW database as the correct estimate of the percentage of resident anglers in the population, anglers are over-represented by a factor of 0.4 in the final sample. Over-representation is greatest in Eastern Idaho and, to a lesser extent, in South Central, North Central, and Southeast Idaho."

Alanna J. Moshfegh

Usual intake means for all of the fish categories are quite similar (about ¾ of an ounce) with the exception of Idaho fish that is much lower, even for the Idaho adult anglers. The low amount for Idaho fish is what I expected to see based on reports being much less frequent. I have no comments on the 50th and 95th percentile intake rates as they are also similar with the exception of Idaho fish. Also, anglers has the highest intake at the 95th percentile which is expected since their mean intakes were higher than all subjects.

Janet A. Tooze

It appears that the NCI method was implemented correctly, and the estimates of usual fish intake appear to be reasonable. The Idaho fish rates are a bit confusing, however. First of all, the analysis was done on those who reported fish intake, but it would be very helpful to know how many people reported Idaho fish consumption intake, and how many people had it on both 8-d recalls, and how many people reported it on the FFQ. It is a little surprising there would be enough people with consumption on both recalls to use the NCI method, and it would be helpful to add this information into the report.

Charge Question 4
Please comment on the analysis and differences in the usual intake means, estimated using the NCI method, to the weighted mean estimates directly from the recall data (without using the NCI method).

Patricia M. Guenther

An individual's intake during a particular time period is an unbiased estimate of his/her usual intake; therefore, the expected value of the population mean usual is the same for both methods. The small differences found are negligible. Within-person variation out does not affect the mean; however, it does affect the other points of the usual intake distribution, and the NCI accounts for that variation. Both methods use the sampling weights. (However, the problems with interpretation of what the recall data represent remain.)

Alanna J. Moshfegh

I may have overlooked this in both reports but I did not find mean intakes from the recall data, just mean intakes from the FFQ. In comparison to the FFQ data, the usual mean intakes are about 10 grams larger. While it is stated that the mean intakes from the recall data are very close

to the usual intake means, it seems for this type of report, such values should be included. In usual intake analysis, mean intakes computed through the usual intake process are usually very close to those estimated directly from recall data. It would be important to look at the mean intakes from the recall data and include these values in the report.

Janet A. Tooze

The differences between the usual intake means from the NCI method and the weighted mean estimates directly from the recall data were small, as expected. Under normality, the mean of the distribution from estimated by the NCI method and the unweighted mean should be the same. This is because the random measurement error does not affect the estimate of the mean, but impacts the estimate of the tails of the distribution, resulting in a more variable distribution, and hence overestimates of the tails of the distribution. Due to small departures from normality (of the transformed data) and due to the backtransformation, the two means may differ somewhat.

Charge Question 5
Are the results of the NCI analysis of usual intake rates scientifically sound and are the results for Idaho fish "valid" for use in derivation of water quality criteria to be protective of human health for the general population and recreational anglers?

Patricia M. Guenther

Because of the question raised about the maximum number of days for each respondent, it cannot be concluded that the results are scientifically sound or fit for use.

Alanna J. Moshfegh

I would say yes. The data collection and statistical analysis to estimate usual intakes used the best methodology available for this type of assessment.

Janet A. Tooze

From what I can tell, the NCI method appeared to have been implemented correctly. I did provide a few points above for which I'd like clarification to make this conclusion. The rates of consumption for Idaho fish in general seem very low, and it is a bit concerning that there were so few consumers of these fish. In general, the NCI method should provide a better estimate of usual intake adjusted for measurement error compared to methods that do not adjust for measurement error, zero intake days, and the skewness of the data. However, the method can be sensitive to small sample sizes, and the sample size should have been small for Idaho fish. I'd like to see the results for Idaho fish consumers only if possible. Also, I am concerned about treating all 8 recall days as "equal."

Charge Question 6
Do you have any other suggestions for improving the scientific quality or utility of the document?

Patricia M. Guenther

If it turns out to be true that a maximum of 2 days are available from the 7-day reference, it may still be possible to analyze the data in a scientifically sound manner, using the NCI method, if the individual days are the observation periods. However, many of the second days will be consecutive to the first. Either this should be stated as a limitation, or perhaps the analysis could account for any correlation concerns (consider the ISU method for 3 consecutive days). Another option would be to use only the repeat observations that are at least 2 days distant from the first. This information should be available in the dataset.

Under this scenario, the value of the "recontact" survey is unclear. If the authors have reason to believe that additional observations from some of the same people can be used to improve the estimates and, therefore, wish to include some of the data from the second ("recontact") phase, respondents who had recall data in the both the "main" and "recontact" phases could be used. Another perhaps more useful option would be to treat the "recontact" sample in the same manner as the "main" sample, and cut the sampling weights of people who appear in both samples in half.

Regardless of the analytic approach taken, assumptions have to be made. For this study, they should all be in the direction of yielding conservative (i.e., high estimates). Assuming the 2 days reported represents all fish consumed during 8 days goes against that principle.

Alanna J. Moshfegh

Specific comments provided below.

Janet A. Tooze

I think I have given all my specific suggestions elsewhere in this response.

VI. SPECIFIC OBSERVATIONS

Specific Observations and Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page Number	**Line Number**	**Comment or Question**
Cover	Title	A better title would be "Distributions of Usual Fish Intakes by Adult Fish Consumers in Idaho, Estimated Using the NCI Method."
Contents	Last line	As an aid to the reader, please give the appendix a title, such "Additional Percentiles and Standard Errors."
1	10	Change "recall" to "intake." It's intake that's measured.
1	Line 10	The phrase 'short-term' could be misconstrued as describing the recall method itself instead of a limited number of days of dietary recalls. Suggest dropping it here and throughout the report. While it is defined on page 3, line 46, capturing intake over a short period of time, this definition is from the NCI glossary on measurement error and is not necessarily the best way to describe the data collection from the Idaho fish consumption survey. Generally, for the method of determining dietary intake, the time-period is usually included as a descriptor such as 24-hour dietary recall or 7-day food record. Suggest that be done in this report. For example, on page 4, line 24+...This data include 24-hour dietary recall data for a reference period of 8 days, . . .
1	13	The questionnaire indicates that the reference period is 7 days, not 8.
1	Lines 13-14	It seems this combined sentence is saying the same thing.
1	14	Please change "multiple recalls" to "two recall periods."
1	14 and throughout	Some readers will object to the term "subjects." "Participants" or "respondents" is preferable.
1	Lines 19-20	Food intake data are usually presented in grams.
1	24-25	This link doesn't work.
1	36	Change "among" to "from" here and throughout. The data from the sample is used to estimate the population parameters.
3	Line 37-38	Suggest deleting 'The Idaho DEQ has contract...' This was state in the introduction.
4	2	Please omit all references to food records. They weren't used in this study. Also, there is no literature on how well people can remember the details of dietary intake over a 7-day period.
4	4	Omit "short-term." It's very misleading here. It would be more objective to omit "short-term" throughout this report. Just say repeat measures of dietary intake.
5	Lines 14-15	Might be helpful to state that there are 12 webinars in the series.
5	35	Please only include the terms relevant to this report. Potential deletions are listed below.
5	42-43	Omit the last phrase. In this study, fish consumption is the only relevant exposure.
6	2	Omit.
6	6	Add "nearly" before "daily."

Specific Observations and Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page Number	**Line Number**	**Comment or Question**
6	13-14	Omit.
6	25-27	Omit.
6	29-30	Omit the phrase following the semicolon.
6	38-40	Add the length of the reference period for this study.
6	43-44	Change to a description of the regression models used in this study.
6	48-49	This definition is problematic for this study. Omit or revise.
7	25-26	Omit the second sentence.
7	Line 29-30	Delete. Already stated on page 5.
7	Line 33	Section on Organization of This Report would be better place right after the Summary and include something about overview of usual intake and dietary data.
7	46	For clarity, please change "from" to "calculated by."
8	Lines 30-44	Not clear why the Kipnis discussion is needed here. Understand that lines 44-45 and 1-2 on page 9 are needed.
9	Lines 4-9	This has been stated earlier. Suggest dropping.
9	29	"As directed by the NCI." Were the NCI employees who consulted on this aware of the sequence effect evident in the data when they made this recommendation? Also, "directed" seems like a very strong word here – I assume that members (presumably statisticians and hopefully nutritionists) were consulted, but I am not sure the NCI would want to be described as directing this work.
9	18-20	See comment on the two samples above.
9	26-38	The statistical approach used seems to assume that 8-day recall includes all the fish that was consumed during those 8 days; but, according to the questionnaire, that was not the case. The recall includes only the first day, which may or may not include fish, and only one other day which does include fish. The second day was not chosen at random.
10	9-15	But the recall questions were asked only of people who reported of the FFQ that they had consumed fish in the past 7 days. Therefore, for the purposes of this study, fish consumers are not people who had fish in the past year, but rather those who had fish in a given week.
11	1	Please be more specific about this variable. What is it exactly? "Collected" should probably be "calculated."
11	3	Add "household" before "income" here and in Table 2.
11	Table 2, American Indian row heading	Add a footnote indicating "Member of an Idaho tribe." According to the companion report, that variable, rather than race category "American Indian/Alaskan Native," is the variable of interest.
12	12-15	Please consider explaining what these person-specific random effects are. Should something be said about the implications of this assumption since a key feature of the NCI method is that it does allow for correlations of frequency and amount of a food consumed?

Specific Observations and Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page Number	**Line Number**	**Comment or Question**
		(See Figure 4 in Tooze et al. (2006).)
13	2	Since this information is not presently available online (and as an aid to the reader in any case), please provide the definitions, perhaps in an appendix to this report.
17	Legend	Omit "All subjects" and similar legends in figures throughout. This isn't accurate, and it's unnecessary because the information is in the title.
23	American Indian label	Omit "Tribe." Add a footnote that says "Member of an Idaho tribe."
46		Market Fish is a subcategory of Non-Idaho Fish. What is the purpose of this graph? It should be two separate graphs.
68	24	For clarity, please change "categories" to "subcategories."

VII. INDIVIDUAL REVIEWER COMMENTS

Review By:
Patricia M. Guenther, Ph.D., RD

Peer Review Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"

Patricia M. Guenther, Ph.D., RD
Guenther Consulting
November 17, 2015

I. GENERAL IMPRESSIONS

The results are clearly presented; however, as described above (see peer review comments on "Idaho Fish Consumption Survey"), it seems possible that the recall data provided for these analyses represent a maximum of 2 days of intake data (not 7 or 8). If that is the case, the accuracy of the information in this report is highly doubtful.

II. RESPONSE TO CHARGE QUESTIONS

1. Please comment the clarity and organization of the report. Does it present information, including tables and figures, in a clear and usable format? If not, please provide suggestions for improving the clarity of the document, which is intended to be useful to state regulators, the scientific community, and other stakeholders, including the general public.

"Fish consumers" included in these analyses consumed fish at least once in the previous 7 days. Therefore, the inferred (target) population is adults who reside in Idaho and who consume fish at least once during any given week. It is not those who consume fish at all during a year as stated in the report. This inferred population is a smaller than the population who consume fish at all during a year, and their fish intakes are higher than those who consume any fish at all during a year. Therefore, the population estimates will be more conservative (i.e., higher) for the intended use than if "fish consumers" had been defined as those consuming fish at all during the past year. This needs to be clarified in the report.

The tables and graphs are clear, except for the graphs that include Non-Idaho Fish and Market Fish. The organization of the report is good, but too much of the information is repeated unnecessarily. Important information should be in both the summary and the body of the report, but nothing else needs to be stated more than once.

2. Please comment on the appropriateness of the application of the NCI technique to the fish consumption survey data available from the NWRG survey, based on short-term dietary recall with a reference period of 8 days, to develop usual intake distributions.

It does not appear that the NCI method was appropriately applied. The approach taken seems to assume that 8-day recall includes *all* the fish that was consumed during the reference period, but that may not be the case. It appears that the data available include only the first day, which may or may not include fish, and only one other day, which does include fish. The second day was not chosen at random, but rather with certainty because it included fish. The survey did not determine on how many days fish was consumed during the reference period. This seems to undermine the sampling theory on which the NCI method relies. If somehow all of this does not matter, then why is does not matter should be explained. In any case, the amount reported for 8

days is actually only for a maximum of 2 days, so it cannot simply be divided by 8 to get a 1-day amount.

It is misleading to say that recalling intake over a period of up to 8 days is a "short-term" recall. It is shorter than a year or 30 days, which is the reference period for many food frequency instruments, but "short-term" recall is typically 1 day, not 8. The validity of the "8-day recall" method has not been established. It would be better to simply avoid the phrase "short-term" when describing the recall for this study.

Did the authors, IDEQ, or NCI consider the possibility of estimating the usual intake distributions from just the days reported during the first contact? If not, why not?

3. Please comment on the presented usual intake means for the populations of interest, Idaho adults and Idaho adult anglers, for all fish, Idaho fish, non-Idaho fish, and market fish. Do you have any comments on the reported 50th and 95th percentile intake rates?

The report would be more useful if an explanation would be offered for why the consumption rates of non-Idaho fish and of market fish separately are of interest.

The decision to analyze the data for anglers as a separate stratum seems to be based on the mistaken belief that that angler data were collected using a separate sampling frame. This decision should be re-visited. The original intent was to have a separate sampling frame, but it was not implemented as explained in the companion report:

"BSU [Boise State University] originally recommended that 2,000 of the 7,000 completed surveys should be completed with anglers. This recommendation was driven by the assumption that anglers would be more likely to consume fish and that an over-sample of anglers would be needed to achieve the necessary number of twice consumers [50] to use the NCI method. During the pretest and after the first six weeks of data collection, a review of the data indicated that approximately 33 percent of those contacted using the general population sample reported that they had a valid license. Therefore, a minimum number of interviews (n = 1,500 or 33 percent of all interviews) with the angler segment was established.

"It was originally believed that use of the list of current license holders would be the most efficient means to reach anglers. The list contained both landline and cell phone numbers, although these were not distinguished. The pretest and first month of data collection used both the RDD sample frame and the IDFW list. High contact and response rates via the IDFW list plus a high incidence of anglers in the RDD sample frame resulted in a significant over-representation of anglers. The decision was made to not use the IDFW list and rely only on the RDD sample frame. In addition to reducing the potential for significantly over-representing anglers, sole use of the RDD sample frames eliminated any frame overlap between the RDD frames and the IDFW sample frame.

"A total of 1,649 anglers were interviewed. Relying on the review of the IDFW database as the correct estimate of the percentage of resident anglers in the population, anglers are over-represented by a factor of 0.4 in the final sample. Over-representation is greatest in Eastern Idaho and, to a lesser extent, in South Central, North Central, and Southeast Idaho."

4. Please comment on the analysis and differences in the usual intake means, estimated using the NCI method, to the weighted mean estimates directly from the recall data (without using the NCI method).

An individual's intake during a particular time period is an unbiased estimate of his/her usual intake; therefore, the expected value of the population mean usual is the same for both methods. The small differences found are negligible. Within-person variation out does not affect the mean; however, it does affect the other points of the usual intake distribution, and the NCI accounts for that variation. Both methods use the sampling weights. (However, the problems with interpretation of what the recall data represent remain.)

5. Are the results of the NCI analysis of usual intake rates scientifically sound and are the results for Idaho fish "valid" for use in derivation of water quality criteria to be protective of human health for the general population and recreational anglers?

Because of the question raised about the maximum number of days for each respondent, it cannot be concluded that the results are scientifically sound or fit for use.

6. Do you have any other suggestions for improving the scientific quality or utility of the document?

If it turns out to be true that a maximum of 2 days are available from the 7-day reference, it may still be possible to analyze the data in a scientifically sound manner, using the NCI method, if the individual days are the observation periods. However, many of the second days will be consecutive to the first. Either this should be stated as a limitation, or perhaps the analysis could account for any correlation concerns (consider the ISU method for 3 consecutive days). Another option would be to use only the repeat observations that are at least 2 days distant from the first. This information should be available in the dataset.

Under this scenario, the value of the "recontact" survey is unclear. If the authors have reason to believe that additional observations from some of the same people can be used to improve the estimates and, therefore, wish to include some of the data from the second ("recontact") phase, respondents who had recall data in the both the "main" and "recontact" phases could be used. Another perhaps more useful option would be to treat the "recontact" sample in the same manner as the "main" sample, and cut the sampling weights of people who appear in both samples in half.

Regardless of the analytic approach taken, assumptions have to be made. For this study, they should all be in the direction of yielding conservative (i.e., high estimates). Assuming the 2 days reported represents all fish consumed during 8 days goes against that principle.

III. SPECIFIC OBSERVATIONS

Specific Observations and Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page Number	**Line Number**	**Comment or Question**
Cover	Title	A better title would be "Distributions of Usual Fish Intakes by Adult Fish Consumers in Idaho, Estimated Using the NCI Method."
Contents	Last line	As an aid to the reader, please give the appendix a title, such "Additional Percentiles and Standard Errors."
1	10	Change "recall" to "intake." It's intake that's measured.
1	13	The questionnaire indicates that the reference period is 7 days, not 8.
1	14	Please change "multiple recalls" to "two recall periods."
1	14 and throughout	Some readers will object to the term "subjects." "Participants" or "respondents" is preferable.
1	24-25	This link doesn't work.
1	36	Change "among" to "from" here and throughout. The data from the sample is used to estimate the population parameters.
4	2	Please omit all references to food records. They weren't used in this study. Also, there is no literature on how well people can remember the details of dietary intake over a 7-day period.
4	4	Omit "short-term." It's very misleading here. It would be more objective to omit "short-term" throughout this report. Just say repeat measures of dietary intake.
5	35	Please only include the terms relevant to this report. Potential deletions are listed below.
5	42-43	Omit the last phrase. In this study, fish consumption is the only relevant exposure.
6	2	Omit.
6	6	Add "nearly" before "daily."
6	13-14	Omit.
6	25-27	Omit.
6	29-30	Omit the phrase following the semicolon.
6	38-40	Add the length of the reference period for this study.
6	43-44	Change to a description of the regression models used in this study.
6	48-49	This definition is problematic for this study. Omit or revise.
7	25-26	Omit the second sentence.
7	46	For clarity, please change "from" to "calculated by."
9	18-20	See comment on the two samples above.
9	26-38	The statistical approach used seems to assume that 8-day recall includes all the fish that was consumed during those 8 days; but, according to the questionnaire, that was not the case. The recall includes only the first day, which may or may not include fish, and only one other day which does include fish. The second day was not chosen at random.
10	9-15	But the recall questions were asked only of people who reported of

Specific Observations and Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page Number	**Line Number**	**Comment or Question**
		the FFQ that they had consumed fish in the past 7 days. Therefore, for the purposes of this study, fish consumers are not people who had fish in the past year, but rather those who had fish in a given week.
11	1	Please be more specific about this variable. What is it exactly? "Collected" should probably be "calculated."
11	3	Add "household" before "income" here and in Table 2.
11	Table 2, American Indian row heading	Add a footnote indicating "Member of an Idaho tribe." According to the companion report, that variable, rather than race category "American Indian/Alaskan Native," is the variable of interest.
12	12-15	Please consider explaining what these person-specific random effects are. Should something be said about the implications of this assumption since a key feature of the NCI method is that it does allow for correlations of frequency and amount of a food consumed? (See Figure 4 in Tooze et al. (2006).)
13	2	Since this information is not presently available online (and as an aid to the reader in any case), please provide the definitions, perhaps in an appendix to this report.
17	Legend	Omit "All subjects" and similar legends in figures throughout. This isn't accurate, and it's unnecessary because the information is in the title.
23	American Indian label	Omit "Tribe." Add a footnote that says "Member of an Idaho tribe."
46		Market Fish is a subcategory of Non-Idaho Fish. What is the purpose of this graph? It should be two separate graphs.
68	24	For clarity, please change "categories" to "subcategories."

Review By:
Alanna J. Moshfegh, MS, RD

Peer Review Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"

Alanna J. Moshfegh, MS, RD
Food Surveys Research Group, Agricultural Research Service, US Department of Agriculture
January 21, 2016

I. GENERAL IMPRESSIONS

The accuracy of the data analysis conducted is sound as the individuals listed are known for conducting this type of analysis. The extensive list of tables in the report and in Appendix A provide a thorough statement and transparency of the analysis. The written parts of the report would greatly benefit from an editor.

II. RESPONSE TO CHARGE QUESTIONS

1. Please comment the clarity and organization of the report. Does it present information, including tables and figures, in a clear and usable format? If not, please provide suggestions for improving the clarity of the document, which is intended to be useful to state regulators, the scientific community, and other stakeholders, including the general public.

Specific comments on the organization of the report and the numerous places where text is duplicated are detailed below. It seemed as if the authors were struggling to fill pages. The data presented in the tables are clear and the format is good.

2. Please comment on the appropriateness of the application of the NCI technique to the fish consumption survey data available from the NWRG survey, based on short-term dietary recall with a reference period of 8 days, to develop usual intake distributions.

Appropriate application as the authors are well-known for conducting this type of highly specialized analysis.

3. Please comment on the presented usual intake means for the populations of interest, Idaho adults and Idaho adult anglers, for all fish, Idaho fish, non-Idaho fish, and market fish. Do you have any comments on the reported 50th and 95th percentile intake rates?

Usual intake means for all of the fish categories are quite similar (about ¾ of an ounce) with the exception of Idaho fish that is much lower, even for the Idaho adult anglers. The low amount for Idaho fish is what I expected to see based on reports being much less frequent. I have no comments on the 50^{th} and 95^{th} percentile intake rates as they are also similar with the exception of Idaho fish. Also, anglers has the highest intake at the 95^{th} percentile which is expected since their mean intakes were higher than all subjects.

4. Please comment on the analysis and differences in the usual intake means, estimated using the NCI method, to the weighted mean estimates directly from the recall data (without using the NCI method).

I may have overlooked this in both reports but I did not find mean intakes from the recall data, just mean intakes from the FFQ. In comparison to the FFQ data, the usual mean intakes are about 10 grams larger. While it is stated that the mean intakes from the recall data are very close to the usual intake means, it seems for this type of report, such values should be included. In usual intake analysis, mean intakes computed through the usual intake process are usually very close to those estimated directly from recall data. It would be important to look at the mean intakes from the recall data and include these values in the report.

5. Are the results of the NCI analysis of usual intake rates scientifically sound and are the results for Idaho fish "valid" for use in derivation of water quality criteria to be protective of human health for the general population and recreational anglers?

I would say yes. The data collection and statistical analysis to estimate usual intakes used the best methodology available for this type of assessment.

6. Do you have any other suggestions for improving the scientific quality or utility of the document?

Specific comments provided below.

III. SPECIFIC OBSERVATIONS

Specific Observations on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page	**Paragraph**	**Comment or Question**
1	Line 10	The phrase 'short-term' could be misconstrued as describing the recall method itself instead of a limited number of days of dietary recalls. Suggest dropping it here and throughout the report. While it is defined on page 3, line 46, *capturing intake over a short period of time*, this definition is from the NCI glossary on measurement error and is not necessarily the best way to describe the data collection from the Idaho fish consumption survey. Generally, for the method of determining dietary intake, the time-period is usually included as a descriptor such as 24-hour dietary recall or 7-day food record. Suggest that be done in this report. For example, on page 4, line 24+...This data include 24-hour dietary recall data for a reference period of 8 days, . . .
1	Lines 13-14	It seems this combined sentence is saying the same thing.
1	Lines 19-20	Food intake data are usually presented in grams.
3	Line 37-38	Suggest deleting 'The Idaho DEQ has contract...' This was state in the introduction.
5	Lines 14-15	Might be helpful to state that there are 12 webinars in the series.
7	Line 29-30	Delete. Already stated on page 5.
7	Line 33	Section on Organization of This Report would be better place right after the Summary and include something about overview of usual intake and dietary data.
8	Lines 30-44	Not clear why the Kipnis discussion is needed here. Understand that

Specific Observations on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page	**Paragraph**	**Comment or Question**
		lines 44-45 and 1-2 on page 9 are needed.
9	Lines 4-9	This has been stated earlier. Suggest dropping.

Review By:
Janet A. Tooze, Ph.D., M.P.H.

Peer Review Comments on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"

Janet A. Tooze, Ph.D., M.P.H.
Wake Forest School of Medicine
November 16, 2015

I. GENERAL IMPRESSIONS

This document was entirely focused on the data analysis of the recall surveys, and really did not provide any real discussion of the implications of the results. It would have been nice to see a little bit more discussion of the assumptions made in the analysis and the implications of the covariate adjustment used, particularly the body size, which is known to be associated with measurement error, and more specific details for each outcome (e.g., were all covariates used in all analyses?). It would have been helpful to have a discussion of using the full 8 days of recall vs. a smaller number of days, and also whether utilizing all 8 days with a sequence effect might have been preferable. In general, the method appeared to have been implemented correctly, but there are some points of clarification needed, particularly for Idaho fish.

II. RESPONSE TO CHARGE QUESTIONS

1. Please comment the clarity and organization of the report. Does it present information, including tables and figures, in a clear and usable format? If not, please provide suggestions for improving the clarity of the document, which is intended to be useful to state regulators, the scientific community, and other stakeholders, including the general public.

I think the report is presented in a logical manner, and there are certainly a lot of tables and figures. The report itself is quite brief and of course could not stand on its own without the other report. It would actually be most useful if the two reports could be integrated and an overall summary could be drafted. There is a lot of analysis presented in this report with very little interpretation.

2. Please comment on the appropriateness of the application of the NCI technique to the fish consumption survey data available from the NWRG survey, based on short-term dietary recall with a reference period of 8 days, to develop usual intake distributions.

In general, dietary recalls tend to exhibit less systematic error than FFQs. Fish is considered an episodically consumed food, meaning that it is not consumed every day. In addition, fish consumption data are generally positively skewed, and there may be positive correlation between the probability of consuming fish and the amount consumed, i.e., those who eat fish more frequently may consume more fish on eating occasions. The NCI Method adjusts for random error, skewed data, episodically consumed foods, and the correlation between probability of consumption and amount. It also may incorporate covariates to adjust for sequence effects, and make estimates for certain population strata. Therefore, the NCI Method is appropriate to use for fish consumption estimates for this survey. However, it is important to note that for this particular implementation of the NCI method, consumption day probability and amount were not

allowed to be correlated with each other, but were assumed to be independent. The report states this was due to "data limitations." It would be helpful to give further information on these "limitations." It may be without having consumption day level data that the correlation cannot be estimated as well as with using 24-hour recalls. Furthermore, the Box-Cox parameter was estimated outside the macro also due to "data limitations." This would not be anticipated to have a large impact on the results. In addition, the "sequence" effect was limited to comparing the two 8-day recalls, but there appear to be sequence effects within the 8-d recalls. It would be helpful to provide a discussion of the impact of these decisions on the results.

It is not clear why gender was not stratified by or included as a covariate in any analyses, particularly since there appear to be gender effects, and most national dietary intake data are stratified by gender.

It is also confusing that the report states that "models were fit separately for the angler and non-angler strata," but results are presented overall. Does this mean they were also run overall, or were the two strata combined? If not, how were anglers treated in the overall analysis? Obviously they have different rates of consumption of Idaho fish from non-anglers.

How were the per kg estimates calculated if body weight is included as a covariate?

The type of backtransformation used and how well data were transformed to normality should be addressed, particularly for the Idaho fish analyses.

3. Please comment on the presented usual intake means for the populations of interest, Idaho adults and Idaho adult anglers, for all fish, Idaho fish, non-Idaho fish, and market fish. Do you have any comments on the reported 50th and 95th percentile intake rates?

It appears that the NCI method was implemented correctly, and the estimates of usual fish intake appear to be reasonable. The Idaho fish rates are a bit confusing, however. First of all, the analysis was done on those who reported fish intake, but it would be very helpful to know how many people reported Idaho fish consumption intake, and how many people had it on both 8-d recalls, and how many people reported it on the FFQ. It is a little surprising there would be enough people with consumption on both recalls to use the NCI method, and it would be helpful to add this information into the report.

4. Please comment on the analysis and differences in the usual intake means, estimated using the NCI method, to the weighted mean estimates directly from the recall data (without using the NCI method).

The differences between the usual intake means from the NCI method and the weighted mean estimates directly from the recall data were small, as expected. Under normality, the mean of the distribution from estimated by the NCI method and the unweighted mean should be the same. This is because the random measurement error does not affect the estimate of the mean, but impacts the estimate of the tails of the distribution, resulting in a more variable distribution, and hence overestimates of the tails of the distribution. Due to small departures from normality (of the transformed data) and due to the backtransformation, the two means may differ somewhat.

5. Are the results of the NCI analysis of usual intake rates scientifically sound and are the results for Idaho fish "valid" for use in derivation of water quality criteria to be protective of human health for the general population and recreational anglers?

From what I can tell, the NCI method appeared to have been implemented correctly. I did provide a few points above for which I'd like clarification to make this conclusion. The rates of consumption for Idaho fish in general seem very low, and it is a bit concerning that there were so few consumers of these fish. In general, the NCI method should provide a better estimate of usual intake adjusted for measurement error compared to methods that do not adjust for measurement error, zero intake days, and the skewness of the data. However, the method can be sensitive to small sample sizes, and the sample size should have been small for Idaho fish. I'd like to see the results for Idaho fish consumers only if possible. Also, I am concerned about treating all 8 recall days as "equal."

6. Do you have any other suggestions for improving the scientific quality or utility of the document?

I think I have given all my specific suggestions elsewhere in this response.

III. SPECIFIC OBSERVATIONS

Specific Observations on "NCI Method Estimates of Usual Intake Distributions for Fish Consumption in Idaho"		
Page	**Paragraph**	**Comment or Question**
9	29	"As directed by the NCI." Were the NCI employees who consulted on this aware of the sequence effect evident in the data when they made this recommendation? Also, "directed" seems like a very strong word here – I assume that members (presumably statisticians and hopefully nutritionists) were consulted, but I am not sure the NCI would want to be described as directing this work.