

Survey Methodology Review: Sea Crab Economic Data Collection
Independent Peer Review Report completed for the Center for Independent
Experts

Danna L. Moore

October 4, 2011

Executive Summary

The CIE panel reviewed the EDR questionnaires, data collection, analyses and research findings related to the annual establishment survey of the BSAI Crab industry. Establishments are businesses (crab harvesters and processors) in this study. Reviewers evaluated the appropriateness of methodology and practices and standards for the EDR survey design, evaluation, and testing. Also evaluated were the data quality practices and procedures as well as data quality assessments that were undertaken with regard to the EDR administration and subsequent variables in survey findings. There are many attributes of the EDR data collection and data quality assessment process that contribute to the validity and reliability of the findings.

- There was a diversity of participants in the review process including: EDR data collection staff, economists, industry representatives, EDR harvester and processors, submitters, industry trade associations, and EDR auditors.
- There are important factors driving the EDR survey response rate and the data collection outcomes.
 - Mandatory reporting by industry submitters is the ONE main factor that keeps response rate high and item completion high.
 - Mandatory reporting is appropriate since industry participants are given exclusive access to a highly valued public resource (the Crab fishery) through quotas that have economic value. Industry participants did not have to pay to have access to this resource but were granted access through their presence in the industry when rationalization for this fishery occurred.
 - Mixed mode survey implementation utilizing web, mail, telephone with a multi phase contact strategy in each phase is a survey best practice and this supports high response rate and completion.
 - Validation of reporting through and audit processes and the use of professional auditors improves data quality and discourages fraudulent reporting and non-reporting.
 - Respondent burden is very high (37 hours). Current survey design increases this burden as a result of shortcomings and problems associated with questions, wording, web, question format, wordy instructions, instruction placement, etc.

The crab fishery industry is complex and the regulatory environment associated with the rationalized industry has lead to comprehensive objectives requiring analyses to evaluate data quality or the Crab EDR. The program has utilized mixed methods to classify the error sources and structure of error for the EDR survey results.

- Data quality assessments carried out to-date utilize and replicate the best science in survey methodology for evaluating data quality, total survey error (specifically measurement error) and are appropriate standards to carry into the future for evaluating EDR data quality.
- Minor revisions to EDR have improved some data quality problems but data quality assessments and analyses indicate more targeted changes would reduce reporting burden and improve survey item response.
- Revisions to the EDR require changes to regulation.

- NDFMC has evaluated data quality and, specifically, measurement error. It has identified the primary sources of this error as stemming from the questionnaire, questions, and respondents rather than from the survey process.
- NDFMC has utilized the best known science and developed multiple metrics to classify the type of measurement error occurring in the Crab EDR survey.
- There is much alignment between the accuracy scoring of EDR variables by the work group, data quality categorical ratings and rankings, and audit findings in determining survey variables with lower data quality and that exhibit more measurement error.

As a result of my review of the volume of evidence and EDR summaries and testimonies I have made a number of recommendations. These recommendations stem from my knowledge, practice, and experience in administering surveys and conducting research in the area of survey methodology for more than 20 years. My recommendations include:

Recommendation 1: Maintain the mandatory reporting requirement for the EDR survey and keep this message on survey communications.

- In any redesign effort consider simplifying this message and placing the message in a highlighted text box on the survey questionnaire out-going envelope in questionnaire mailings and on web survey introduction screens.

Recommendation 2: Consider controlled experiments for evaluating changes in data collection.

- When the stakes of the survey data collection are high, it pays to consider doing experiments and cognitive interviews to evaluate factors and attributes of the survey data collection suspected of impacting unit response or item response. It is important to substantiate any focus group or cognitive interview findings with a controlled data collection experiment as a more definitive result to drive changes for questionnaires and data collections.

Recommendation 3: Redesign web and SAQ questionnaires and change matrix table questions.

- Make each item to be a question. Make intended question texts look like questions with font and placement.
- Avoid the use of table header labels.
- Subordinate instructions and present so as to not be confusing or confused with questions.
- If response choice items need data entry codes, place them in such a way as to not be confused with question numbers.
- Place instructions on web screens and questions so they are located where respondents need them for answering each question.
- In redesign, take full advantage of the versatility and functionality of web designing to help reduce complexity for the questionnaire and questions to decrease respondent burden and errors.

Recommendation 4: Initiate and make change to EDR regulation to allow EDR survey instruments and process improvement.

- This includes targeted questionnaire revisions and data collection improvements to questions that show higher levels of data quality problems and higher levels of measurement error.
- Change questions or make decisions about collection that will reduce submitter reporting burden and reduce item nonresponse.

Recommendation 5: Follow through with providing EDR submitters with an audit report that identifies their errors in survey item completion and items with unsupported documentation for values provided in EDR.

Recommendation 6: Continue to use the tiered categorical rating classification of variable data quality, the Relative Ratio, and regression analyses for EDR variables.

Recommendation 7: Consider use of Latent Class analyses for evaluating question problems and estimating measurement error since the Crab EDR is longitudinal and a census population survey. This may inform the survey measurement error if this program is to be initiated with other fisheries.

Recommendation 8: Consider use of Latent Class Analyses for evaluating question wording problems and estimating Measurement Error and adjustments since the EDR is longitudinal and a population study.

Recommendation 9: Utilize the professional services of a survey expert that has experience in economic surveys, questionnaire visual design and usability, and strong mixed mode establishment survey methodology background.

Background and Scope

Scope of Work and CIE Process: The National Marine Fisheries Service’s (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) was established by the NMFS Project Contact and Contracting Officer’s Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers were selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance to the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer was contracted to deliver an independent peer review report to be approved by the CIE Steering Committee. The report was expected to be formatted with content that meets the requirements as specified in **Annex 1**. The SoW described the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the NMFS project: ***Bering Sea Aleutian Islands Crab (BSAI) Fisheries Economic Data Collection Program***.

Project Description: : In 2005, the Bering Sea and Aleutian Islands (BSAI) crab fisheries underwent a drastic change in management regime, moving to an individual quota-based system (also referred to as “rationalization”) which involved both harvesters and processors. Among the Council’s objectives in rationalization are addressing excess harvesting and processing capacity, and improving the economic performance of the crab fisheries by addressing low economic returns and economic instability for harvesters, processors, and communities. In anticipation of potential changes in the magnitude and distribution of benefits, employment, and other social and economic effects of the fishery, the North Pacific Fishery Management Council (Council) tasked the Alaska Fisheries Science Center (AFSC) with leading the development and implementation of an extensive and mandatory annual data collection program (referred to as Economic Data Reports, or EDRs). The EDR program was designed to collect detailed cost, earnings, and employment data from crab fishery participants to support computation of a number of specific performance metrics to evaluate the effects of rationalization on fishery participants and to provide data and analysis in support of future management changes.

The final design of the data collection, including data elements and survey instruments/questionnaires, was developed with extensive industry consultation and review by the Council. The final design was specified in detail in the Code of Federal Regulations (CFR). The EDR reporting requirement went into effect in 2006, with EDR baseline data submission required retroactively for 1998, 2001, and 2004 and subsequently, on an annual basis, for calendar year crab fishing activities for 2005 to present. The annual deadline for completed data reporting forms submission is July 1 for the previous calendar year. Significant data quality

limitations, associated with questionnaire design, were apparent with the first EDR submissions in 2006. To date, extensive efforts have been taken to investigate and validate the quality of the information reported in the EDR forms. Several informal focus groups were held with EDR submitters and a more formal review has been conducted as follows:

- the contractor collecting the data in conjunction with the AFSC has prepared annual reports documenting questions raised by submitters and known or potential flaws in questionnaire design.
- a certified public accountant has been contracted to conduct annual records-check validation by means of random and for-cause audits on subsets of the submitted EDRs and supporting financial records.
- a formal industry committee established by the Council has conducted two reviews of the EDR forms and audit findings and provided data quality and reporting burden assessments.
- statistical and qualitative results of audit findings and industry assessments have been incorporated into a detailed metadata document and distributed for public review.
- the Council's Scientific and Statistical Committee has reviewed the metadata.
- and the Council has received a staff discussion paper on EDR data quality limitations and endorsed constraints on use of a substantial subset of EDR data.

The EDR is a census of all crab fishery participants in the harvest and processing sectors and compliance is a mandatory condition of annual permit renewal. As such, data quality limitations do not arise from sampling design or unit nonresponse error. Rather, data quality limitations arise principally from error sources associated with availability and accuracy of records maintained by submitters, flaws in questionnaire design (including specification errors, excessive computations required of the submitter, and incompatibility with standard industry recordkeeping conventions), and coverage and measurement error due to frame design and changes in industry structure. Revisions to EDR forms were incorporated in 2006 and 2007 to address some identified data quality concerns; however, revisions are limited by specifications set forth in the CFR. Further measures to improve data quality and utility, and reduce submitter burden, will require substantial redesign of the EDR program and associated regulatory specifications. The Council has initiated a process to review the analytical objectives of the EDR program and develop revised regulations and reporting requirements. This process is currently ongoing, with decisions regarding objectives and data reporting requirements expected in December of 2011.

The objective of the CIE review is to identify appropriate methodological best practices and standards for survey design, evaluation, and testing, and to define data quality assurance and data quality control QA/QC procedures to be employed in the EDR program redesign and subsequent administration. The program falls within the class of statistical data collection referred to in the scientific literature as an establishment survey, for which the existing methodological literature is limited and exists largely in government statistical agency documents, conference proceedings, and institutional knowledge. As an agency, NOAA Fisheries is relatively inexperienced with

regard to conducting establishment surveys, particularly with respect to industry financial information, although it does conduct a number of administrative record reporting systems that include financial information. NOAA largely lacks specialized staff expertise and institutional knowledge of relevant methodologies and scientific standards for establishment survey methods for financial information and data QA/QC methods and standards appropriate for different data uses (e.g., administrative, research, or policy/management program evaluation). As such, a broader objective of the CIE review is to identify institutional gaps in appropriate managerial and scientific expertise to carry out statistical social and economic data collection as mandated by the Magnuson-Stevens Act in the context of regulated fishing business establishments.

The CIE panel members were selected on the basis of their expertise in establishment survey design methodology and implementation in regulated industries, survey data QA/QC, and analysis of economic performance of business establishments in commercial fisheries or similar statistical and/or regulatory and industry settings. Panel members were expected to review the documented record of the analytical objectives and process of crab EDR design, evaluation, testing, and data QA/QC employed to date in order to identify process and technical/scientific shortcomings, develop recommended best practices, objective standards, and evaluative criteria in these areas as applicable to the program setting and objectives. To the extent that the scope of the CIE review did not permit the specification of methodological best practices and standards in sufficient detail to be implemented directly in EDR program redesign, the panel was expected to provide recommendations for process improvements and development of appropriate institutional capacity to enable further methodological development and defensible standards in establishment survey design, evaluation, testing, and data QA/QC in this and other fishery economic data collection programs.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting was presented in **Annex 3**.

Description of Reviewer 2's Role and Expertise

CIE Reviewer 2: Danna L. Moore was selected for this review for her knowledge, experience, and expertise in Survey Methodology, Establishment Surveys, and Economic studies. She has working knowledge and recent experience in the application of survey research. She is the Associate Director of the Social and Economic Sciences Research Center (SESRC) at Washington State University (WSU). She holds a Ph.D. in Agricultural Economics. Dr. Moore is an expert in the use and methodology of survey design and administration as they apply to data collection for research, management analysis, and regulatory compliance in the context of regulated industries. She has competitively sought, managed grants, and completed research for contracts valued at more than \$10 million for SESRC. Much of her grant and contract research is interdisciplinary and conducted in conjunction with scientists and researchers at Universities, state and federal agencies. Dr. Moore has a well-established record of publication that includes

the results from studies of survey research methodology in the context of business establishments and survey methodology. She also has publications in the area of economics. Dr. Moore is actively engaged (currently and in the very recent past) in research that addresses theoretical or methodological advances related to the use of establishment survey methods and institutional best practices for economic survey design and administration.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

July 19, 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
August 8, 2011	NMFS Project Contact sends the CIE Reviewers the pre-review documents
August 23-25, 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting.
September 9, 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
September 23, 2011	CIE submits CIE independent peer review reports to the COTR
September 30, 2011	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Danna Moore Reviewer 2-Summary of Terms of Reference (TORs-Annex 2)

1. Review and discussion of data collection and analytical objectives defined by the Council, and associated data quality objectives, as context for evaluation of methods under ToR's 2 through 10.

The location of the meeting and individuals in attendance were very appropriate and an added resource for the CIE reviewers. The meeting was held at the Alaska Fisheries Science Center, Seattle WA and lasted from Tuesday August 23, 2011 to Thursday August 25, 2011. In addition to the three (3) external review panel experts and the meeting chair, there were:

- **a number of representatives from NOAA.**

These included researchers and economists that have analyzed and worked with the crab fishery data. Also in attendance were individuals that were responsible for various survey data collection activities for obtaining information from producers/harvesters and oversight of creating, maintaining, and producing a database of responses to surveys. These individuals were important to providing the perspective of the usefulness of the data, the problems in contacting and collecting from crab harvester/quota holder respondents, the nature of specific measures, and for providing insight into the uniqueness of the circumstances for survey activities in the context of this regulatory environment. Also important was the knowledge of using the survey data in economic modeling.

- **attendees from the crab fishery industry (producer/harvesters, processor, and quota holders).**

These individuals provided context from the industry side as to what it was like to be asked to produce information from their individual harvester/producer businesses in accordance with questions as presented in the crab data questions and (survey questionnaire) data reporting form.

- **accountants that perform data validation checking of producer/harvester EDRs.**

In attendance were a few accountants that represent the group of accountants that interact with industry. They review and report the accuracy of harvester/producer/processors survey question answers. These are the recorded and submitted answers compared to record checks (each business' financial records and other information) used to produce survey responses at the question level.

There are many uses for surveys and there are just as many views about surveys. Often times in conversations about a particular survey, communications can get strained. This strain is usually the result of a divergence of opinions and perspectives in how the different types of individuals relate to the survey. In trying to evaluate a survey and its outcomes, it is important to have a diversity of views in the room evaluating and discussing the data and the processes related to developing that data. Many academic disciplines are involved when it comes to understanding surveys and survey errors. Also important is the perspective of how different groups of individuals relate to the survey data as either providers or users. The review panel and the various types of attendees at this meeting represented well the diversity of perspectives and the varied roles pertaining to the BSAI Crab EDR.

2. Evaluation and findings regarding establishment survey questionnaire design, evaluation, and testing methodology employed to date and recommendations for improvement

Survey Factors Driving Response and Data Collection

A very important aspect of the Bering Sea Crab harvester/producer survey data collection is that it is a mandatory annual data collection survey program. This survey data collection is referred to as Economic Data Reports (EDRs). As a mandatory data collection survey, this requires owners of crab vessels and processors to submit detailed operational and financial information as related to their current/most recent harvesting/production business activities. It should be noted that this survey has a very high response burden at 37 hours per response. In a typical voluntary survey with economic and financial questions, this would be a severe deterrent to response and the survey response rate and data quality would most likely be much lower than what is experienced for the BSAI Crab EDR.

From a survey evaluation perspective, the mandatory response requirement is one of the most important aspects of this survey that leads it to have a high level of reporting and a high level of reported data quality. The problems with the annual EDR are not associated with non-response error or sampling error. This survey is a census survey of fishery participants (BSAI Quota Holders/licensing). Since no sampling is conducted there is no sampling error. To continue in the fishery the next year requires respondents (fishers) having complied with the completion and submission of the previous year crab EDR. This condition is a very powerful motivator since further continuation in the industry and any further monetary gains for the fisher are directly connected with the provision of survey information asked for by the North Pacific Fishery Management Council (Council) and provided for by the Code of Federal Regulation (50 CFR part 680 and under section 402(a) of the Magnuson-Stevens Act (16 U.S.C. 1801, et seq) for the rationalized crab fisheries. The message shown on the Crab EDR 2010 questionnaire cover:

“..Pursuant to the legislation, the data and identifiers will also be used for program enforcement and determination of quota shares. Consequently, identifiers and data will be disclosed to NOAA Enforcement, NOAA General Counsel, the Antitrust Division of the Department of Justice, the Federal Trade commission and NOAA Restricted Access Management Program. ”

The survey research literature provides examples of experimental testing comparing factors associated with response including the use of a mandatory reporting requirement message(s) in survey communications. Survey messages and appeals can be made part of survey communications in numerous ways. Requirement messages can be printed in the body of one or more contact letters, printed on envelopes, or printed as part of the questionnaire. The message can also be emphasized with varied intensity such as replicating the message in each communication or by boxing and increasing the font size so that it stands out as a singular important message on the envelope or elsewhere. Specifically, mandatory reporting requirements are discussed in Dillman, Singer, et al (2000). In this study, extensive experimental tests associated with the Decennial Census aimed at understanding the factors that improved the likelihood of response found 5 factors significant out of the 16 factors tested. The most powerful was the inclusion of a text box (with larger font) on the outgoing

envelope that informed recipients that “U.S. Census Form Enclosed; Your Response is Required by Law”. Even though the EDR data collection with its use of the mandatory response message has not been experimentally tested as a factor, it is this reviewer’s opinion that this is the main reason that response rates over time have not proven to be a problem.

Item response on economic and financial questions most likely has better than average unit completion and data quality (as compared to voluntary industry commodity surveys) because respondents are told that this has a mandatory reporting requirement (condition), is enforceable, and respondent’s survey completion impacts continuation in the industry (i.e. receiving quota/license/permit approval).

The survey factor viewed as the second most important towards maintaining survey response and for motivating improved data quality reporting at the item level is survey completion as validated by certified legal accountants. The process of validation legitimizes the claim that the CFR can and most likely will be enforced. This process step is very persuasive and encourages serious attention by the respondent and the legal business entity. People are most persuaded 1) when they have a reason to do so, and 2) when there is a clear benefit or cost to them. To comply with this step has a transaction cost as it is somewhat difficult, it is time consuming and it requires showing their personal sensitive business information to an outside party. However, in this case:

Recommendations: 1) Maintain the mandatory reporting requirement and keep this message on survey communications; and 2) In any redesign effort consider simplifying this message and placing the message in a highlighted text box on the survey questionnaire out-going envelope in questionnaire mailings and on web survey introduction screens.

Recommendation: When the stakes of the survey data collection are high it pays to consider doing experiments and cognitive interviews to evaluate factors and attributes of the survey data collection suspected of impacting unit response or item response. It is important to substantiate any focus group or cognitive interview findings with a controlled data collection experiment as a more definitive result to drive changes for questionnaires and data collections.

3. Evaluation and findings regarding data collection administration and data management to date and recommendations for improvement

Data Quality Problems and Assessments

Data quality limitations have been principally attributed (by data users and by NOAA economists) to be from error sources other than non-response or sampling. Mainly, they view item response errors to be principally associated with the availability and accuracy of records maintained by submitters, flaws in questionnaire design (including specification errors, excessive computations required of the submitter, and incompatibility with standard industry recordkeeping conventions), and coverage and measurement error due to frame design and changes in industry structure.

As a survey researcher, I agree with this assessment and would add to this list of factors contributing to item response problems and data quality problems.

In discussions and comments provided by industry participants (quota holders/processors and industry representatives), many find the most difficult questions associated with the EDR to be when costs and other economic questions are asked to be broken out and attributed to the specific crab species that are tracked and monitored under the program. These individuals report and suggest the answers to these questions are fraught with error and are inaccurate. One of their arguments is that most fishery participants and vessels are engaged in more than one fishery, and that sometimes these multi-species fishery activities (fishing for ground fish during a crab fishing trip) overlap and/or are combined into one trip's costs. Cost information is recorded or monitored in this way (by the trip for a vessel) and this does not match how the crab EDR asks cost and revenue questions to be mutually exclusive and reported by the crab species fishery.

As a survey researcher and economist, I would agree with respondents this is a problem and leads to inaccurate question and item responses. When looking at item response and measure error, those questions identified by respondents as difficult or as having problems because they don't match how they keep their records are good candidates for investigation or further research. As a general rule and if at all possible, data collectors should try to collect production and economic information at the item and question level in the same form (unit level quantities, cost, prices) as the respondents know it or as they record it in their own business records. To ask respondents to manipulate or calculate economic measures that are atypical record items leads to increased variation in estimation and reported responses. Any subsequent manipulations should be done in secondary data analysis.

Accountants and Data Validation

Comments by accountants that perform record validation checks with industry members say they also have problems validating information with respondents and looking at their recorded information to see how they arrived at their answers to economic survey questions. They indicated that in many instances on these same types of problematic questions all they can really record is whether or not they used information such as invoices, billings, receipts to make their allocations to economic quantitative question items. Accountants report in many instances, answers to specific questions are based on estimations. They indicate that there is strong variation in how thorough respondents are with their record keeping activities and practices. Some have no real record system, some have boxes of invoices and receipts as records, and then there are those that have good record keeping systems. However, they all reported problems with respondents allocating item expenses (such as vessel fuel) to the crab species level of reporting.

This is a typical type of problem with quantitative questions and economic survey questionnaires with commodity producers other than Crab fisheries. In many studies, respondents are asked to make their best estimate. I have seen these same types of problems in commodity surveys collected in voluntary research surveys, and for state and federal agency economic surveys. The approaches I am aware of or that I have been involved with

use cognitive interviews, in-depth interviews with respondents about their record keeping, and understanding of questions as methods to improve question wording. Almost all longitudinal surveys of respondents such as those in agriculture will use experiments to verify that questionnaire changes or survey process and implementation changes work compared to a control condition. This type of research can be done in-conjunction with accompanying records checks to understand how quantitative information is recorded and summarized by respondents for their businesses.

A more recent approach by some agencies is that they are taking economic business information in the form that respondents keep it. Any further breakdown of answers to sub categories is done using secondary sources of information. Additionally, they may use set assumptions based on research findings for allocating or disaggregating cost information. For example the Washington State Department of Transportation has conducted research to establish typical fuel, maintenance, repair costs for operating Tractor trailers, Heavy Trucks, Light Trucks, Vans, Heavy Cars and Light Cars. This information is used to establish percentage of operating costs associated with each category of vehicles. In surveys, respondents are asked to “agree” or “disagree” with that percent of cost or cost range for their business vehicles and this is then used in estimation of business costs. If they disagree they are asked to further explain how their percent of costs are more or less than those offered.

Another approach is to identify those questions that could be determined from other sources of administrative data or personal-identified data located in other government agencies to improve the quality of information. For instance, if data for crab species or subspecies is collected on the fish ticket or other off loadings that are recorded at the time product is delivered to the docks or to processors, this information could be tracked and preloaded into web questionnaires for use by respondents to help answer current year production/harvest questions. Not only does this reduce burden for the respondent, but it can vastly improve data quality.

Consider web redesign to reduce complexity and to improve ease of answering.

In reviewing the web questionnaires (provided in paper copy), I noticed that they look just like the paper based form and present questions in matrix format that allow for multiple row and column recordings or entries. Each row and column has a header but there is no use of a succinct question for each item to cue the respondent. Matrix design is a very complex format and task. For some respondents they may have difficulties understanding how to complete these types of forms and to understand what question is being asked when only headers are used. Matrix presentation on the web is currently much like the presentation of a paper based SAQ form. One way to reduce respondent burden is to use yes/no screening questions to then subsequently show only those questions to the respondent that are appropriate or applicable. SESRC has found that it is advantageous to use one question per screen as a recommended format. This provides plenty of space to provide subtext instructions and the use of auto features like roll-overs or drop box lists.

In the EDR, there is currently a separate upfront presentation of complicated instructions that does not take advantage of the functionality and capability of the web to reduce respondent

burden. In the eyes of the respondent, this greatly increases the burden of responding and they are much less likely to check or use instructions. When transaction costs are high or more effort is required, the data quality on each question or item asked about decreases. These items have high item non-response. We also see high abandonment from completing a given survey on these types of questions. Survey researchers recommend that respondents are most likely to read and use instructions when they are located with or available within the question structure. The web is very versatile as a tool when it comes to providing features that can be used to aid or prompt respondents with instructions to improve question answers and quality of estimates if they are economic. Mouse roll-over, embedding definitions or inclusion/exclusion statements included within or as subtext can be used to make instructions more succinct and available where they are needed. Drop down/pop-up list features are main stream features on web instruments and many internet users are very familiar with and expect these types of aids when completing forms and surveys.

Some examples: The certification page does not have the look of questions that need to be answered. It is confusing. It visually looks like and reads like definitions or instructions and has an unusual presentation of the “Buttons to be checked” with a number next to them. I believe these numbers are answer codes. Question text is light un-bolded font and instructions are bolded. Which is more important, the question or the instruction? The recommended convention is to have the question with a question number and the question text bolded. Instructions should have a distinct look but be subordinated to the question text. Instructions should be placed with the question but look visually different. Currently the answer choices are numbered and in separate boxes so they look like separate questions. Below is a screen shot of a portion of the page from annual catcher/processor Crab EDR 2010.

CERTIFICATION PAGE – 2 of 2	
Select one of the following statements and provide any requested information. Check one box below. Note: The descriptions below refer to leasing of the vessel. Do not provide information regarding any quota leasing here – questions will be asked about quota leases in the EDR form.	
<input type="radio"/>	1. You are the catcher/processor owner , and you harvested or processed BSAI crab in the above described vessel during the 2010 calendar year. Complete and submit <u>entire EDR</u> for the 2010 calendar year.
<input type="radio"/>	2. You are the catcher/processor leaseholder , you harvested or processed BSAI crab in the above described vessel during the 2010 calendar year. Complete and submit <u>entire EDR</u> for the 2010 calendar year.

Recommendation: Redesign web questionnaires and questions. Make each item to be a question. Make question texts to look like questions with font and placement. Avoid the use of table header labels. Subordinate instructions and present so as to not be confusing or confused with questions. If response choice items need data entry codes, place them in such a way as to not be confused with question numbers. Place instructions on web screens and questions so they are located where respondents need them for answering each question. In redesign, take full advantage of the versatility and functionality of web designing to help reduce complexity for the questionnaire and questions to decrease respondent burden and errors.

The following are examples of screening questions that could be used to only show those matrix tables needing to be answered by the respondent. Force choice yes/no answer format have been shown in recent research by Don Dillman and others to improve data quality.

Qx. In 2010, did you (your business) participate or harvest...

Yes No

- Eastern Aleutian Islands Golden Crab Fishery?
- Western Aleutian Islands Golden Crab Fishery?
- Bering Sea Snow Crab Fishery?
- Bering Sea Tanner Crab Fishery?
- Bristol Bay Red Crab Fishery?

For example if the respondent for the EDR replies “Yes” to only one of the above screening questions such as the Bering Sea Snow Crab Fishery and the remaining Q’s are “No” , that respondent is given only one set of questions (one Matrix table) relating to only Bering Sea Snow Crab Fishery and the remaining matrix tables are not presented. This lessens the response task in that respondents do not have to view or read these tables and the overall questionnaire they completed is much shorter and has less questions.

Another way to decrease response burden, improve the ease in answering questions and increase response accuracy for questions on each matrix table is to use pull down menus selection and to integrate important instructions or options for looking up short abbreviations, acronyms, and other definitions accessible while in the Species matrix question table. On each Crab Species Question Matrix table the species code (Table B), common name, scientific name could be preloaded or made available as a pull-down list for selection of the item to be reported in the question matrix table. Crab product codes (Table C) can also be made available as preloaded or for item selection from a pull down list showing code and description. Same is true also for Table D Crab Process codes and descriptions, Table E Crab size codes, and Table F Crab grade codes.

4. Evaluation and findings regarding protocols and metrics, for data quality assessment employed to date and recommendations for improvement

Data Quality Assessment

Due to the complexity and diversity of the Crab fishery industry and the comprehensive nature of the analytical objectives, the program as originally designed has produced data of varying degrees of accuracy and there has been a high need and an extensive effort undertaken to understand the factors impacting data quality and to understanding the nature of error that have arisen in survey data collection for the EDR.

Classification of error sources in the EDR survey data are very important to provide a framework for describing and differentiating observed errors identified in the data quality assessment process. This classification is very useful for understanding the implications of the different types of errors, to understand the data quality limitations and to provide a means for correcting measures and improving the data collection process. This process has focused mainly on describing errors that impacted the accuracy and precision of survey measures. A very important part of this process has been third party auditing which was employed to evaluate errors made by submitters and was necessary to maximize survey information useful for analysis. Auditing has characterized the accuracy and precision of the data as it was collected, and identified error sources that could be corrected.

It is my opinion that the audit process is highly important, and I would like to recap the audit validation procedure as described in documents. The EDR audit validation process: 1) annually selects EDR variables for indices calculation and randomly selects from remaining variables; 2) random audit sample 95% confidence level and 15% precision level randomly EDR from population of EDR records; 3) outlier review and selection for audit is based on high degree of deviation from population mean across a given set of variables; 4) for-cause audits are selected from vessels that did not comply with audit request of previous year; 5) notice of audit and solicitation of supporting records is given to selected vessels/processors are informed of audit selection; 6) appropriate forms are identified and submitters are directed to provide calculations/sources for estimated values; 7) item nonresponse observations are identified and submitters are directed to correct the nonresponse and provide documentation. Additional contact efforts are made to give an opportunity to respond in a timely manner and error detection and correction is maximized to the extent possible; 8) support classification: supporting documentation and estimation methods are evaluated and coded to distinguish different types of measurement or response errors. The coding scheme has evolved through iteration, with 1998-2005 data classified as supported/unsupported/not available, and a more detailed classification scheme in use since 2007 (see Table 1). The classifications are intended to better identify the nature of the measurement error, if any, and provide some indication of the effect of survey design error (Biemer, 2010). Overall, I feel it is important to note that I consider this audit validation process as described to the review panel in oral and written evidence as a fair process that

allows submitters/stakeholders to interact with auditors and to correct submitted information without penalty if they make a legitimate effort to reconcile.

Based on the work of Biemer (2010) and others in data quality and survey research literature, the outcome sought for the data quality evaluation was to provide quantitative measures of error using a Total Survey Error framework and to inform efforts needed to redesign the EDR data collection process. This effort recognizes and incorporates multiple attributes and dimensions of data quality including qualitative and subjective dimensions as well as objective, measurable attributes along the lines recommended by Wang and Strong in 1996.

Most surveys are balancing the need to maximize accuracy against other goals such as completeness, timeliness, costs, and respondent burden. For the crab fishery the various types of data collections vary considerably, from highly monitored critically accurate face-to-face/observer based data collection from vessels at landings to data collection after the season completed by mail and web surveys with Fishery businesses. These later efforts collect more general level cost and earning information and are acknowledged as less precise. While the first collection demands accuracy for in season industry management and administration, the second is used to evaluate effects of management on fishery sectors and groups of stake holders.

Secondly, the actual audit of Fishery population EDR submissions has strongly emphasized to the industry that the EDR is very important to government and that the threat of enforcement for non-compliance and poor survey reporting is real and likely. I have no doubt that in such a small industry with limited number of stakeholders the power of “word-of-mouth” about the audit experience and the amount of additional time it takes has greatly reinforced the need to put a quality effort towards completing EDR surveys. I’m sure most businesses in the fishery would just as soon avoid the audit rather than endure it multiple times. It seems that it would be easier to comply than resist.

It is very impressive that the NPFMC and the AFSC as a review and oversight group have created and achieved indicators for measurement error and processing error. Where measurement error has been defined and accepted in the survey research community as the difference between the observed or reported value of a variable and the true but unobserved value of that variable. Whereas, process error occurs after the survey data are reported and during the conversion to electronic data that can be analyzed. From the presentations, reviewing materials, and the process for data collection from the relatively small population of EDR submitters, process error is not viewed as a significant problem in terms of Total Survey Errors. The Crab EDR survey process utilizes the most important elements known to achieve high response and that is implementing multiple contacts with submitters, and in particular using following-up contacts with non-respondents at set intervals with new letters and replacement questionnaires. The EDR uses multiple modes (mail, telephone and web) questionnaires as ways to complete the survey and contacts alternate survey contact modes.

Since the population is small, having dedicated staff person to contact respondents is important for maintaining rapport and building confidence and trust with the respondent pool. This person can have personalized interactions and answer questions in a way that further engenders trust. According to the survey researcher, Don Dillman explaining the social exchange theory of survey response, respondents are more likely to answer surveys when trust and benefits of the survey (as viewed by respondents) outweigh the costs for completing and returning the survey.

It is my opinion that the presentation of information and material evidence for the EDR has substantiated that the errors experienced in data collection are mostly to be classified as measurement error. Measurement error comes from four primary sources in survey data collection: the questionnaire; the data collection method (survey mode ---web, mail, telephone, and face to face implementation); the interviewer, as the deliverer of the questions; and the respondent, as the recipient of the request for information. Each of these sources can introduce error into the measurement process. For the most part, I think the evidence presented to the panel for review demonstrates that much of the error occurring in estimates is associated with measurement error due to questions, questionnaires, and EDR respondents as submitters of Fishery information. Questionnaire effects I have noted that could be improved include question presentation, overly burdensome and difficult to use instructions, lack of wording on questions in matrix presented tables for answers, lack of question numbers, graphics, and symbols to help with navigation, lack of definitions, and lack of streamlined navigational path through the questionnaires. While this is a long list, not all is as bad as this might suggest. In my opinion, as a survey researcher and from a questionnaire visual design standpoint, while these attributes of data collection have not been “Best of Practice” known-to-date, the current design has still yielded “Fit for Use” data. The reason I provide that data remains to be useable even though there are questionnaire problems is attributed to the fact that submitters are longitudinal respondents and are accustomed to the current questionnaire presentation and know they are required to submit this data to stay or be allowed to harvest under the quota allocation and rationalized Fishery. Respondent effects that I see suggested by results and Q/A evaluation include misunderstanding the meaning of the questions, failing to recall the information accurately or maintaining accurate records, and failing to construct the response correctly (e.g., by summing the components of an amount incorrectly). In some cases, the evidence points to the interaction effect of respondents and questions as the source of the problem. Industry representatives and auditors suggest that proportioning some types of information (such as trip item costs) to crab species is difficult as multiple fishery activities may be occurring in one trip and this is problematic. I agree the data quality tables indicate this is an area of concern.

The results of the submitter feedback survey and the submitter contact logs (post-rationalization EDR submission) identified difficulties associated with question

interpretation, missing financial and operating records, and excessive reporting burden. Submitter difficulties and logs of questions asked were important stakeholder feedback loops on the EDR process. Feedback by submitters was provided on a voluntary basis and submitters did indeed provide input. This is a sign of a healthy and respectful process. This stakeholder investigative effort principally identified potential sources for reporting error. However, this is without providing a statistical basis for estimating a quantitative effect on the accuracy of reported data.

In most instances, to-date changes in the EDR form added more instructions to clarify the intended object to be reported and to reduce reporting error, and did not substantively alter question or questionnaire design. Adding more instructions as a process step is evidence and suggests respondents are missing or not understanding instructions that are already provided in the instrument and definitively misinterpreting questions and not understanding what information is requested.

5. Evaluation and findings regarding data quality control standards employed to date and recommendations for improvement

Measurement errors are difficult to quantify, and require some method of acquiring additional quantitative information on which to base an assessment of the data collected in the primary survey. The auditing process was very important to establishing the validity of reported data for the EDR from submitters. Also, error classification (Table 1 Audit validation codes, Accuracy scoring of variables, and Burden Score by variable) and audit results suggest important improvements to questions, the questionnaire, and maybe a change to a higher level consideration of more careful alignment for the multiple data collections in the Crab Industry at all points and just where specific data might be collected most efficiently and accurately. Also suggested in presentations and from written information is the idea that maybe “other sources” than the EDR may be just as useful for obtaining some information since there are overlaps and redundancy occurring in some of data collected (e.g. fish tickets, EDRs, and ship logs). I agree that this is an important approach to evaluate to reduce respondent burden and improve accuracy of specific variables. In summary, it is my opinion that the type of measurement error documentation, classification, and analyses of survey error as undertaken for the Crab Fishery EDR is quite unprecedented in the survey world and for most government agencies. This industry is relatively small and the number of reporting entities are declining or consolidating. This situation increases the burden and importance of achieving high response rates and high quality item response. As the number of industry members decline and there is more control of information by a very small number of harvesters and/or processors there will be increasing importance to the quality of the data reported and to a process that guarantees accuracy of information. The guardians of this public resource need to know that reported fishery information is accurate and not manipulated to maintain the public’s trust and to strongly protect Crab as a valuable natural resource.

6. Evaluation and findings regarding analytic methodologies and treatment of uncertainty employed to date and recommendations for improvement

The treatment for uncertainty as described in the EDR Data Quality Summary has employed acceptable and correct analytic techniques. The main treatment of uncertainty in this research has been to describe and make assessments about the data quality that is associated with measures from the EDR. In social science measures, and survey data especially, it is recognized that uncertainty is present and that the goal is to determine the sources of uncertainty, to make efforts to reduce the factors that contribute to uncertainty and to provide guidelines on the magnitude of data quality problems associated with any estimate. It is most important that documentation on data limitations be available to any users of the data or to those who may analyze it for policy decisions. Data limitations by variable are well documented and have provided more than on estimation the degree of measurement error or data inaccuracies.

The strength of the analyses is that numerous sources have been used to try and understand the sources and degrees of uncertainty related to data quality problems on each variable. PSMFC EDR program has conducted: 1) feedback survey of EDR submitters; 2) they have kept contact logs about the call ins and the questions asked and clarifications sought from submitters during (annual) data collections; 3) they have debriefed and collected information from auditors; 4) they have contacted and had specific meetings with industry participants about the EDR; 5) they have tracked difficulties submitters have had associated with questions, their meanings, and when item data on financial and operations variables and other variables have had larger numbers of missing responses or non-response. As much as possible, it seems that program staff accessed external sources on methods and research to learn as much as possible towards documenting record checks and using the literature on validation for survey type studies.

Auditing is one of the most important sources of information for dealing with uncertainty as it provides both quantitative and qualitative assessments about the EDR variable and about EDR submitters. Most importantly, the audit process has reviewed variables with several criteria for audit validation, namely—random selection, specific annual selection of variables important to indices are validated by audit; and other variables are rotated in for audit. Outliers and EDR observations with high levels of statistical deviation are identified using multiple measures and then are sent for audit. Vessels are specifically selected “for-cause” if they did not report in a previous year. Interestingly, the number of the “for cause” has been reduced to zero since 2006.

A very positive new step is to give EDR submitters an audit report that identifies their errors or findings that were unsupported values. This is highly likely to improve submitter’s reporting, reduce the number of audits, and reduce the number of repeat audits. In turn, this action may also reduce enforcement actions. Overall for submitters this will help reduce uncertainty for them interacting with the EDR survey and questions over time.

Most admirably, the PSMFC EDR program staff have developed and implemented a tiered ranking for variables (Category A to C) that describes and characterizes EDR data elements towards Data Quality status, the level of limitations of the data quality, and how reliable it is for use in data analyses and econometric modeling. These also describe the recommendations

towards adjustment for limitations. This documentation will facilitate the usability of the EDR database for users.

Another very creative novel development for the EDR data base was the use of work groups to agree on an assignment to EDR variables of two scores: 1) the Accuracy score—(1= high accuracy, 2= average accuracy, and 3=poor accuracy); and 2) the Respondent Burden score—(1= reflecting easy to report, 2=average difficulty to report at requested level of detail, and 3=difficult to report at the requested level of detail). All three of these scores and ratings will prove to be very useful in evaluating questions and measures for targeted improvement in questionnaires, questions, or the decision to look for alternate sources for information.

In addition to the scoring criteria, some statistical analyses were employed to develop quantitative metrics of measurement error and allow for describing EDR variables (by year and sector) relative to each other and this provides a data quality assessment relative to audit findings. The Reliability Ratio (RR) has a value of 0 to 1. The closer the RR for a variable is to 1, the more reliable the variable is. The closer the RR value is to zero for a variable, the less we can trust the reliability. This is a very useful measure to evaluate variables and survey question measures and target for question improvements (wording or other features) to improve estimates.

Regression analyses of audit validation data (based on the work of Fuller, 1984) proved to be very helpful in framing the structure of Measurement Error as systematic or not relative to three testable hypotheses. These analyses calculated the F statistic and determined whether the ME biased is described as: 1) constant fixed bias (positive or negative) based on whether the model intercept is significantly different from 0; 2) existence in the data of bias reported by submitters as proportional to the magnitude of the reported value that is whether the slope parameter is significantly different than 1; and 3) whether both types of bias are jointly present in the data—rejection of the null hypothesis indicates nonrandom errors and systematic bias in estimates.

Overall, it is a fairly rare instance in survey data to have validation data available to assess measurement error. That there are numerous ways of assessing measure error associated with variables helps reduce the uncertainty that variables targeted as more error-prone should be improved or not in questionnaire redesign or decisions be made about collection of specific information is warranted. As revealed in the various data quality analyses, the degree of unsupported values in audits has decreased over time. However there is still a significant proportion of variables (25%) that show non-randomness in measurement error identified by auditors and these variables have to do with labor, captain share, fuel costs and quantity, etc. These are influenced by extreme correctly reported values and some outliers. I agree with results that indicate there is a need to use analytical methods to report aggregate economic information and correct for the types of disturbances found in the EDR data.

Recommendation: Use the tiered categorical rating classifications of data quality, the Relative Ratio (RR), and the regressions developed for EDR variables to inform others that may use this data in analyses with regard to measurement error.

7. Evaluation and findings regarding interpretation and conclusions of data analyses employed to date and recommendations for improvement

My answer to this question is included above in item number 6.

8. Explicit determination as to whether this NMFS project presented the best available science

In my opinion as the survey methodology reviewer, this NMFS research project has carried measurement error analyses further and to a greater extent than most government agencies are able to. I think the economists, survey staff, auditors, and others stakeholders have all provided interesting insight to understanding this data collection. The measurement error analysis as presented is very interesting and a novel approach to evaluating survey data quality and assessing measurement error of self reported business information. I think this effort is important information generated towards improving EDR questionnaires and the data collection.

My opinion is that the information shared about the EDR data collection is in concurrence with the best science known in survey methodology and measuring the survey error. More importantly, I feel the EDR survey and process of verification is an important example of a “Gold Standard Measurement” inability to fully reconcile or validate submitter’s reports. This measurement error process for the EDR used an “Audit Process” of submitters’ reports and compared these to their financial records. This audit was conducted by certified/licensed trained professional accountants that knew the industry. This is an extraordinary and expensive process to verify and validate survey data. This process showed that when accountants tried to verify through record checking and questioning to reconstruct or improve the respondent’s answers to questions about the business they could not do so in every case for a number of specific reasons. These reasons included: 1) respondent based problems such as lack of records (bills, invoices, or specific types of or insufficient landing or catch logs) and or poor fishery business financial accounting practices; and 2) question or questionnaire problems such as dividing out cost and revenue to crab subspecies and multi-fishery harvesting activities done in one trip of a vessel. In these instances auditors do not produce any better or more accurate question answers than the respondents. This suggests that some EDR questions have problems and that data asked for is not kept in that way or it is unknown. In these instances all that auditors could verify was: 1) what assumptions were used by the submitter, 2) whether or not records were kept, and 3) the recorded information and a logical process was used to come up with their answer. Accountants could not verify if answers were correct, nor could they verify the degree of accuracy of the answer(s). This points to three types of remedies: 1) providing standards for each type of problem so all accountants are handling and recording auditing outcomes the same way; 2) consider redesigning specific survey questions and wording identified as problematic; and 3) looking for alternative sources for the same information. Examples of the later are information in other places such as administrative records, other records for submitters on fishery catch; or records in other agencies. There is one more way to address this situation and that is to use a

statistical technique called Latent Class Analyses (LCA) to evaluate measurement error. Without further investigation and review of the survey data over time by subgroups of respondents, I cannot say at this time without further research, if this would completely work for making statistical estimates of measurement error and subsequently appropriate statistical adjustments. LCA is a method that has been used to identify problems in questionnaire design and wording of questions.

Recommendation: Consider use of Latent Class Analyses for evaluating question wording problems and estimating Measurement Error and adjustments since the EDR is longitudinal and a population study.

9. Recommendations for further improvements, including all elements of the EDR program development and evaluation process and appropriate institutional and scientific capacity

I do not have the expertise to comment on the development of the EDR fisheries program, institution, and scientific capacity.

I do feel it appropriate to make mention that consultation and expertise in the area of survey questionnaire design, data collection, and evaluation would be appropriate as EDR questionnaire redesign is considered. Any consultant considered should have expertise in collection of economic survey data, survey methodology and design, questionnaire design (mail, web, and telephone), visual design, and an understanding of measurement error and total survey error.

Recommendation: Utilize the professional services of a survey expert that has experience in economic surveys, questionnaire visual design and usability, and strong mixed mode establishment survey methodology background.

10. Brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations

These are not available for review at the time of submission of this document.

References:

- Alwin, D. F. (1989) Problems in the estimation and interpretation of the reliability of survey data. *Quality and Quantity*, 23, 277-331.
- Biemer, P.P. and C. Wiesen (2002) "Measurement Error Evaluation of Self Reported Drug Use: A Latent Class Analysis of the US National Household Survey on Drug Use" *Journal of the Royal Statistical Society. Series A (Statistics in Society)*, Vol. 165, No. 1, pp. 97-119.
- Dillman, D.A., J.D. Smyth, L.M. Christian (2009) *Internet, Mail, and Mixed Mode Surveys: The Tailored Design Method*. John Wiley & Sons Inc. Hoboken, New Jersey.
- Dillman, D.A., Singer, E., Clark, J. R. & Treat, J. B. et al. (1996) Effect of benefit appeals, mandatory appeals, and variations on confidentiality on completion rates of census questionnaires. *Public Opinion Quarterly*, 60, 376-389.

Appendix 1: Bibliography of Materials Provided for Review and Supplemental References

- Abbot, K., B. Garber-Yonts and J. Wilen. 2010. Employment and remuneration effects of IFQs in the Bering Sea/Aleutian Island crab fisheries. *Marine Resource Economics* 25:333-354.
- AKT LLP. 2010. "Alaska Crab Economic Data Report Data Validation: Report Prepared for Pacific States Marine Fisheries Commission, 2009 Calendar Year Data," Portland, OR: Pacific States Marine Fisheries Commission, 8 p.
- Alaska Fisheries Science Center. 2009; 2010. Annual Catcher/Processor Crab Economic Data Report (EDR). NOAA Fisheries, , Seattle, WA.
- Alaska Fisheries Science Center. 2009; 2010. Annual Catcher Vessel Crab Economic Data Report (EDR). NOAA Fisheries, , Seattle, WA.
- Alaska Fisheries Science Center. 2009; 2010. Annual Shoreside Processor Crab Economic Data Report (EDR). NOAA Fisheries, , Seattle, WA.
- Alaska Fisheries Science Center. 2004; 2006. Historical Catcher/Processor Crab Economic Data Report (EDR), Calendar Year 2004. 2006. NOAA Fisheries, Seattle, WA.
- Alaska Fisheries Science Center. 2004; 2006. Historical Catcher Vessel Crab Economic Data Report (EDR), Calendar Year 2004. 2006. NOAA Fisheries, Seattle, WA.
- Alaska Fisheries Science Center. 2004; 2006. Historical Shoreside Processor Crab Economic Data Report (EDR), Calendar Year 2004. 2006. NOAA Fisheries, Seattle, WA.
- Alaska Fisheries Science Center (AFSC). 2010. BSAI Crab Economic Data Report Database: Metadata. 2010. NOAA Fisheries, , Seattle, WA.
- Alaska Fisheries Science Center (AFSC). 2011a. BSAI Crab EDR Database Data Quality Summary. Economics and Social Science Research Program, August 10, 2011.
- Alaska Fisheries Science Center (AFSC). 2011b. Public Announcement, Bering Sea and Aleutian Islands Crab Fisheries Economic Data Collection Program External Independent Peer Review by the Center for Independent Experts Panel Review Meeting, August 23-25, 2011 NOAA Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA
- Garber-Yonts, B. and J. Lee. 2010. Stock Assessment and Fishery Evaluation Report for King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions: 2010 Economic Status Report. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.

- Magnuson Stevens Fishery Conservation and Management Act (MSFCMA). 2007. Public Law 94-265 as amended by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (P.L. 109-479). An Act to provide for the conservation and management of the fisheries, and for other purposes. As Amended Through January 12, 2007. <http://www.nmfs.noaa.gov/sfa/magact/>
- Minor, S. 2011. Written statement provided to the CIE review team. August 24, 2011.
- National Marine Fisheries Service (NMFS). 2009. National Standard Guidelines. 50 C.F.R. 600.310 et seq., updated 8/29/ 2009. http://www.nmfs.noaa.gov/sfa/reg_svcs/Councils/Training2010/Tab%20F%20%20Introduction%20to%20MSA%20&%20National%20Standards/Handouts/Tab%20F2%20%20Nat%20Standards%20guide%20910.pdf
- National Marine Fisheries Service (NMFS) Alaska Region. 2011. Crab Rationalization website. <http://www.fakr.noaa.gov/sustainablefisheries/crab/crfaq.htm>
- National Oceanic and Atmospheric Administration (NOAA) 2006. NOAA Information Quality Guidelines. http://www.cio.noaa.gov/Policy_Programs/IQ_Guidelines_110606.html
- National Research Council (NRC). 2000. *Improving the Collection, Management and Use of Marine Fisheries Data*. Commission on Geosciences, Environment and Resources (CGER), Ocean Studies Board (OSB), National Academy of Sciences. Washington, DC: National Academies Press.
- North Pacific Fishery Management Council. 2010a. Five-Year Review of the Crab Rationalization Management Program for Bering Sea and Aleutian Islands Crab Fisheries. Appendix A. Social and Community Impacts. Anchorage, AK. December 28, 2010. http://www.fakr.noaa.gov/npfmc/current_issues/crab/5YearRev1210_AppxA.pdf
- North Pacific Fishery Management Council. 2010b. Discussion paper on economic data collection. February 2010.
- North Pacific Fishery Management Council. 2010c. Discussion paper on economic data collection. October 2010.
- North Pacific Fishery Management Council. 2011. April 2011 Meeting Minutes. <http://www.fakr.noaa.gov/npfmc/minutes/411Council.pdf>
- North Pacific Fishery Management Council AP. 2011. April 2011 Meeting Minutes. <http://www.fakr.noaa.gov/npfmc/minutes/AP411.pdf>
- North Pacific Fishery Management Council SSC. 2011. April 2011 Meeting Minutes. <http://www.fakr.noaa.gov/npfmc/minutes/SSC411.pdf>

North Pacific Fishery Management Council (NPFMC) and National Marine Fisheries Service (NMFS). 2004a. Final Environmental Impact Statement for the Bering Sea and Aleutian Islands Crab Fisheries. August 2004.

<http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm>

North Pacific Fishery Management Council (NPFMC) and National Marine Fisheries Service (NMFS). 2004b. Appendix 1 to the Final EIS: Regulatory Impact Review/ Initial Regulatory Flexibility Analysis, Voluntary Three-Pie Cooperative Program for the Bering Sea And Aleutian Islands Crab Fisheries. August.

[Http://Www.Fakr.Noaa.Gov/Sustainablefisheries/Crab/Eis/Final/Appendix1_Rir.Pdf](http://www.fakr.noaa.gov/sustainablefisheries/crab/eis/final/appendix1_rir.pdf)

Pacific States Marine Fisheries Commission (PSMFC). 2007. 2006 Economic Data Report (EDR) Data Collection Difficulties. 205 SE Spokane Street, Suite 100 Portland, OR. July 2007.

Resource Data, Inc. 2011. Alaska Fisheries Information Network Economic Data Reporting (EDR) Program. System and Process Analysis. Version B1.0. 431 North Franklin St., Suite 400, Juneau, Alaska 99801.

Tyler, G. 2011. Power Presentation to the CIE Review Team on EDR data entry and administration at PSMFC.

Appendix 2: CIE Statement of Work for Dr. Danna Moore

External Independent Peer Review by the Center for Independent Experts

Review of the Bering Sea and Aleutian Islands Crab Fisheries

Economic Data Collection Program

Scope of Work and CIE Process: The National Marine Fisheries Service’s (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer’s Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: : In 2005 the Bering Sea and Aleutian Islands (BSAI) crab fisheries underwent a drastic change in management regime, moving to an individual quota-based system (also referred to as “rationalization”) which involved both harvesters and processors. Among the Council’s objectives in rationalization are addressing excess harvesting and processing capacity, and improving the economic performance of the crab fisheries by addressing low economic returns and economic instability for harvesters, processors, and communities. In anticipation of potential changes in the magnitude and distribution of benefits, employment, and other social and economic effects of the fishery, the North Pacific Fishery Management Council (Council) tasked the Alaska Fisheries Science Center (AFSC) with leading the development and implementation of an extensive and mandatory annual data collection program (referred to as Economic Data Reports, or EDRs). The EDR program was designed to collect detailed cost, earnings, and employment data from crab fishery participants to support computation of a number of specific performance metrics to evaluate the effects of rationalization on fishery participants and to provide data and analysis in support of future management changes.

The final design of the data collection, including data elements and survey instruments/questionnaires, was developed with extensive industry consultation and review by the Council. The final design was specified in detail in the Code of Federal Regulations (CFR). The EDR reporting requirement went into effect in 2006, with EDR baseline data submission required retroactively for 1998, 2001, and 2004 and subsequently, on an annual basis, for

calendar year crab fishing activities for 2005 to present. The annual deadline for completed data reporting forms submission is July 1 for the previous calendar year. Significant data quality limitations, associated with questionnaire design, were apparent with the first EDR submissions in 2006. To date, extensive efforts have been taken to investigate and validate the quality of the information reported in the EDR forms. Several informal focus groups have been held with EDR submitters and more formal review has been conducted as follows:

- the contractor collecting the data in conjunction with the AFSC has prepared annual reports documenting questions raised by submitters and known or potential flaws in questionnaire design
- a certified public accountant has been contracted to conduct annual records-check validation by means of random and for-cause audits on subsets of the submitted EDRs and supporting financial records
- a formal industry committee established by the Council has conducted two reviews of the EDR forms and audit findings and provided data quality and reporting burden assessments
- statistical and qualitative results of audit findings and industry assessments have been incorporated into a detailed metadata document and distributed for public review
- the Council's Scientific and Statistical Committee has reviewed the metadata
- and the Council has received a staff discussion paper on EDR data quality limitations and endorsed constraints on use of a substantial subset of EDR data.

The EDR is a census of all crab fishery participants in the harvest and processing sectors and compliance is a mandatory condition of annual permit renewal. As such, data quality limitations do not arise from sampling design or unit nonresponse error. Rather, data quality limitations arise principally from error sources associated with availability and accuracy of records maintained by submitters, flaws in questionnaire design (including specification errors, excessive computations required of the submitter, and incompatibility with standard industry recordkeeping conventions), and coverage and measurement error due to frame design and changes in industry structure. Revisions to EDR forms were incorporated in 2006 and 2007 to address some identified data quality concerns; however, revisions are limited by specifications set forth in the CFR. Further measures to improve data quality and utility, and reduce submitter burden, will require substantial redesign of the EDR program and associated regulatory specifications. The Council has initiated a process to review the analytical objectives of the EDR program and develop revised regulations and reporting requirements. This process is currently ongoing, with decisions regarding objectives and data reporting requirements expected in December of 2011.

The objective of the CIE review is to identify appropriate methodological best practices and standards for survey design, evaluation, and testing, and to define data quality assurance and data quality control QA/QC procedures to be employed in the EDR program redesign and subsequent administration. The program falls within the class of statistical data collection referred to in the scientific literature as an establishment survey, for which the existing methodological literature is limited and exists largely in government statistical agency documents, conference proceedings, and institutional knowledge. As an agency, NOAA Fisheries is relatively inexperienced with regard to conducting establishment surveys, particularly with respect to industry financial information, although it does conduct a number of administrative record reporting systems that include financial information. NOAA largely lacks specialized staff expertise and institutional

knowledge of relevant methodologies and scientific standards for establishment survey methods for financial information and data QA/QC methods and standards appropriate for different data uses (e.g., administrative, research, or policy/management program evaluation). As such, a broader objective of the CIE review is to identify institutional gaps in appropriate managerial and scientific expertise to carry out statistical social and economic data collection as mandated by the Magnuson-Stevens Act in the context of regulated fishing business establishments.

The CIE panel members will be selected on the basis of their expertise in establishment survey design methodology and implementation in regulated industries, survey data QA/QC, and analysis of economic performance of business establishments in commercial fisheries or similar statistical and/or regulatory and industry settings. Panel members are expected to review the documented record of the analytical objectives and process of crab EDR design, evaluation, testing, and data QA/QC employed to date in order to identify process and technical/scientific shortcomings, develop recommended best practices, objective standards, and evaluative criteria in these areas as applicable to the program setting and objectives. To the extent that the scope of the CIE review does not permit the specification of methodological best practices and standards in sufficient detail to be implemented directly in EDR program redesign, the panel is expected to provide recommendations for process improvements and development of appropriate institutional capacity to enable further methodological development and defensible standards in establishment survey design, evaluation, testing, and data QA/QC in this and other fishery economic data collection programs.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an independent peer review during the panel Review Committee (RC) meeting scheduled in Seattle during 23-25 August 2011. The CIE reviewers shall have the requested expertise necessary to complete an impartial peer review and produce the deliverables in accordance with the SoW and ToR and as stated below:

CIE Reviewer 1 shall have working knowledge and recent experience in the application of fishery economics. This reviewer must be an expert in applied economic research and policy/management analysis in commercial fisheries, and must have a well-established record of publication that includes the results of applied analyses in commercial fisheries management. It is also desirable to have familiarity with financial accounting practices in fishing/seafood processing and comparable industries and experience in US federal fisheries management would be beneficial.

CIE Reviewer 2 shall have working knowledge and recent experience in the application of survey research. This reviewer must be an expert in the use and methodology of survey design and administration as they apply to data collection for research, management analysis, and regulatory compliance in the context of regulated industries. The reviewer must also have a well-established record of publication that includes the results from studies of survey research methodology in the context of business establishments. In addition, the reviewer must be engaged (currently or in the very recent past) in research that addresses theoretical or

methodological advances related to the use of establishment survey methods and institutional best practices for economic survey design and administration.

CIE Reviewer 3 shall have working knowledge and recent experience in the application of data validation and data QA/QC methodology. This reviewer must be an expert in practical and statistical data quality assessment and data validation in the context of recordkeeping and monitoring of regulated industries. Experience with financial accounting practices in small to medium scale business enterprises and application of US Federal Information Quality Act requirements to collection of financial and business data from regulated industries by federal agencies. Experience with records-check validation methods would be useful.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting in Seattle, Washington during the 23-25 August 2011 as specified in the Schedule of Milestones and deliverables herein.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering committee, the CIE shall provide the CIE reviewer information (name, affiliation, and contact details) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and information concerning other pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: <http://deemedexports.noaa.gov/sponsor.html>).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

The following background documents will be provided in preparation for the peer review.

1. Annual Catcher/Processor Crab Economic Data Report (EDR), Calendar Year 2009. 2010. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
2. Annual Catcher Vessel Crab Economic Data Report (EDR), Calendar Year 2009. 2010. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
3. Annual Shoreside Processor Crab Economic Data Report (EDR), Calendar Year 2009. 2010. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
4. Historical Catcher/Processor Crab Economic Data Report (EDR), Calendar Year 2004. 2006. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
5. Historical Catcher Vessel Crab Economic Data Report (EDR), Calendar Year 2004. 2006. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
6. Historical Shoreside Processor Crab Economic Data Report (EDR), Calendar Year 2004. 2006. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
7. Five-Year Review of the Crab Rationalization Management Program for Bering Sea and Aleutian Islands Crab Fisheries. 2010. North Pacific Fishery Management Council, Anchorage, AK. December 28, 2010
8. Discussion paper on crab economic data collection. 2010. North Pacific Fishery Management Council, Anchorage, AK. October 2010.
9. Discussion paper on economic data collection. 2010. North Pacific Fishery Management Council, Anchorage, AK. February 2010.
10. Final EIS for BSAI King and Tanner Crab Fisheries. NOAA Fisheries. August 2004.
11. Garber-Yonts, B. and J. Lee. 2010. Stock Assessment and Fishery Evaluation Report for King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions: 2010 Economic Status Report. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
12. Alaska Crab Economic Data Report Data Validation: Report Prepared for Pacific States Marine Fisheries Commission, 2009 Calendar Year Data. 2010. AKT, LLP, Portland, OR. November 2010.
13. 2006 Economic Data Report (EDR) Data Collection Difficulties. 2007. Pacific States Marine Fisheries Commission, 205 SE Spokane Street, Suite 100 Portland, OR. July 2007.
14. BSAI Crab Economic Data Report Database: Metadata. 2010. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.
15. BSAI Crab EDR Database: Data Quality Summary. Updated January 30, 2008. NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA.

This list of pre-review documents may be updated up to two weeks before the peer review. Any delays in submission of pre-review documents for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables. Furthermore, the CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein.

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall**

be approved by the COTR and CIE Lead Coordinator. Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified in the contract SoW. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer will assist the Chair of the panel review meeting with contributions to the Summary Report. CIE reviewers are not required to reach a consensus, and should instead provide a brief summary of their views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

- 1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review;
- 2) Participate during the panel review meeting in the Seattle during 23-25 August 2011 as called for in the SoW, and conduct an independent peer review in accordance with the ToRs (Annex 2);
- 3) No later than REPORT SUBMISSION DATE each CIE reviewer shall submit an independent peer review report addressed to the “Center for Independent Experts” and sent to Mr. Manoj Shivilani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in Annex 2;
- 4) CIE reviewers shall address changes as required by the CIE review in accordance with the schedule of milestones and deliverables.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

July 19, 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
August 8, 2011	NMFS Project Contact sends the CIE Reviewers the pre-review documents
August 23-25, 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting.
September 9, 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
September 23, 2011	CIE submits CIE independent peer review reports to the COTR
September 30, 2011	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be made through the Contracting Officer’s Technical Representative (COTR) who submits the modification for approval to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the CIE within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and Terms of Reference (ToR) of the SoW as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToRs and deliverable schedule are not adversely impacted. The SoW and ToRs cannot be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (the CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards: (1) each CIE report shall have the format and content in accordance with Annex 1, (2) each CIE report shall address each ToR as specified in Annex 2, (3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon notification of acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR.

The COTR will distribute the approved CIE reports to the NMFS Project Contact and regional Center Director.

Key Personnel:

William Michaels, Contracting Officer's Technical Representative (COTR)
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

NMFS Project Contact:

Ron Felthoven
National Marine Fisheries Service
Alaska Fisheries Science Center – F/AKC2
7600 Sand Point Way NE, Seattle, WA 98115
Ron.Felthoven@noaa.gov Phone: 206-526-4114

Brian Garber-Yonts
National Marine Fisheries Service
Alaska Fisheries Science Center – F/AKC2
7600 Sand Point Way NE, Seattle, WA 98115
Brian.Garber-Yonts@noaa.gov Phone: 206-526-6301

Appendix 3: Panel Membership

The review panel consisted of four persons:

Dr Chris Anderson (Chair)

Associate Professor, Department of Environmental and Natural Resource Economics
University of Rhode Island, Kingston, RI

Dr Susan Hanna

Professor Emeritus of Marine Economics
Oregon State University Corvallis, OR

Dr Danna Moore

Associate Director, Social & Economic Sciences Research Center
Washington State University, Pullman, WA

Dr Richard Wang

Director, MIT Information Quality Program
Massachusetts Institute of Technology, Cambridge, MA