

**Crab Economic Data Collection
North Pacific Fishery Management Council
October 2010**

As a part of its Bering Sea and Aleutian Island crab rationalization program, the Council developed an economic data collection program to provide information to analysts to assess the effects of the program and future amendments to the program. Participants in the programs assert that costs of submission are extraordinary and that data cannot be accurately and consistently reported across respondents, preventing their use for some of their intended purposes. In addition, participants assert that several relevant factors are unobservable, preventing the use of the data for analyses as intended.

At its February 2010 meeting, the Council received a discussion paper from staff concerning economic data collection, which suggested a process that could be used to refine existing programs and advance future programs. The Council directed staff to begin advancing the suggested process through an assessment of the crab economic data reporting program. This assessment would be used to consider revisions to the program. Specifically, the Council requested that the assessment:

- 1) Summarize Council's initial purposes for collection of data (based on Council's initial action on data collection)
- 2) Assess each data element currently collected based on its
 - Accuracy
 - Cost of collection
 - Utility for informing management decisions

This assessment would draw on prior data assessment of Alaska Fisheries Science Center, Pacific Northwest Crab Industry Advisory Committee, and various industry workgroups.

- 3) Develop suite of alternative data collection amendments for Council consideration.

This paper is staff's response to the Council's request. The first part of the paper summarizes the initial purpose for the data collection program, outlining both the purpose for the data collection, as well as listing some of the estimates that analysts intended to generate with the data. The second part of the paper briefly discusses the accuracy, cost of collection, and utility of the current data collection program. A more detailed summary is included as an appendix. The third part of the paper is intended to be used by the Council to shape a future action to modify the data collection. Rather than define specific data elements that could be included in alternatives, that section attempts to provide a framework that the Council could use to develop alternative data collection measures. That discussion could be used to develop a purpose and need statement, to guide the Council in development of specific alternatives at this meeting or provide staff guidance for the development of more specific alternatives that the Council could consider adopting for analysis at a future meeting. Using this approach will allow the Council to more specifically construct an amendment package to address its priorities and concerns.

The Council's rationale for data collection and its data collection motion

In June 2002, early on in the development of the crab economic data collection program, the Council adopted an expansive motion identifying its purpose for pursuing data collection. Although lacking some specificity, the motion suggests that collected data would be used to examine the economic and social effects of the rationalization program on harvesters, processors, regions, and communities. In an attempt to further understand the Council's objectives, analysts relied on the following five problems identified in the purpose and need statement for the rationalization action:

- i. Resource conservation, utilization and management problems;
- ii. Bycatch and its associated mortalities, and potential landing deadloss;

- iii. Excess harvesting and processing capacity, as well as low economic returns;
- iv. Lack of economic stability for harvesters, processors and coastal communities; and
- v. High levels of occupational loss of life and injury.

Based on these identified problems, analysts suggested measures that could be used to examine the success of the program in achieving objectives. Since the data collection program was intended to address economic aspects of the fishery, only the third and fourth problems were pursued in the data collection. To examine these objectives, the analysts identified a number of measures and the data necessary to estimate those measures. These include:

Excess harvesting and processing capacity and low economic returns

For both the harvest sector and processing sector:

- 1) capacity and capacity utilization
- 2) profits
- 3) quasi-rents
- 4) productivity
- 5) technical efficiency
- 6) allocative efficiency

Computation of these measures requires the following data:

- a) variable input quantities and prices
- b) capital quantities and fixed costs
- c) catch quantities and prices (species)
- d) input quantities and prices
- e) output quantities and prices by product form

Lack of economic stability for harvesters, processors, and coastal communities

For both the harvester sector and processor sector:

- 1) Distribution of ex vessel revenue
- 2) Distribution of product revenue
- 3) Distribution of profits and quasi rents within and between harvesters and processor
- 4) Distribution of privileges within the harvesting and processing sectors
- 5) Seasonality of catch and revenues by location
- 6) Vertical integration
- 7) Domestic and foreign ownership
- 8) Harvesting employment and payments to harvesting crews
- 9) Processing employment and payments to processing crews
- 10) Involvement of crab fishery participants in other fisheries
- 11) Value of privileges
- 12) Regional economic impacts

Computation of these measures requires the following data:

- a) Vessel owner information
- b) Plant owner information
- c) Catch
- d) Landings
- e) QS and PQS ownership information
- f) Harvester crew employment and compensation
- g) Processor crew employment and compensation
- h) QS and PQS prices and quantities transferred
- i) Expenditures by location
- j) Crew residence information

The Council's preferred alternative for data collection omits non-variable (or fixed) cost data from the collection, except to the extent necessary to understand variable costs¹. In addition, the data collection focuses on crab fishery data. Certain of these data are collected at the level of individual crab fisheries to provide more detailed information for analyses, as fisheries differ in their prosecution. Other data are crab only costs, while some additional data are collected for all fisheries.²

Assessment of the existing collection

The program collects data from catcher vessels, catcher processors, shore based processors, and floating processors. Several assessments of the quality of data collected have already been undertaken by agency staff and industry, including the Pacific Northwest Crab Industry Advisory Committee. These assessments are relatively consistent in their views of the quality of the data, with some notable exceptions. The attached data assessment (see [Appendix 2](#)) summarizes information from these prior assessments develop a simplified evaluation of the quality of each data element, as well as the cost associated with reporting. This summary assessment is framed to provide a backdrop for the development of alternatives to revise the data program in the future.

In reviewing the assessments and fashioning revisions to the data collection program, the Council should primarily assess the extent to which the collection of data elements will improve information concerning the fisheries. An assessment of the utility of the data collected poses certain challenges. First, the utility of a data element is dependent on several aspects of that element and its collection. The information value of a data element often arises directly from the nature of the factor that it represents. For example, landings by a vessel are particularly informative, as they are representative of a vessel's production from the fishery. Spending on paper supplies used to maintain logs and business records is less fundamental to understanding the fishery. Utility is also dependent on the accuracy of the data. Inaccuracy (or even unknown accuracy) can substantially diminish utility by leaving analysts (and policymakers) uncertain of the reliability of any analytical results. In addition, a data element's utility will also depend on the information of the element relative to other data currently collected. Data concerning product forms and sizes may be informative, but (depending on the fishery) may represent only a marginal improvement over data on product sizes alone. Lastly, the utility of data elements may vary with other data availability. For example, pot purchases may provide useful and relevant information concerning a vessel's expenditures, but without knowing whether the vessel shares pots owned by other vessels in its cooperative, these costs are less informative (and possibly provide misleading information) concerning the vessel's operation and costs. Each of these different aspects is considered in assessing the utility of the data.

A review of the metadata (or the table accompanying this document concerning data quality) suggests that the data collection in their current form have (and, in the near future, will continue to have) several

¹ Should the Council wish to continue to use this rationale for inclusion of fixed cost data in the collection program, the analysis could reexamine fixed cost variables based on this criteria.

² Subsequent to the passage of rationalization, the 2006 reauthorization of the MSA modified authority for the analysis of socioeconomic impacts and the collection of economic and social data. These changes eliminate certain restrictions on the collection economic data (particularly from processors) and are interpreted by agency representatives as mandating broader economic data collection. In addition, an initiative within the agency to develop a standard set of social and economic performance measures and data collection is currently underway. A review of these broader, agency-level initiatives is beyond the scope of the discussion requested in the Council's motion; however, the Council may wish to request a review of current status of NOAA and NMFS economic data collection initiatives, as well as alternative sources for data collection in the crab fisheries relevant to redefining the objectives of the data collection program. These structural changes should be considered in the further development of the data collection program.

limitations. Several elements are not accurately or consistently reported.³ In addition, the reviews of the data submissions suggest that barriers (surmountable only with considerable and time consuming efforts) are likely to prevent the accurate and consistent collection of some of these items in the near future. Other elements provide only partial information concerning operations in the fisheries. For example, the collection includes only purchased bait, although many vessels in the crab fisheries harvest a portion of their bait. To estimate quasi-rents (a suggested goal for the data collection program) would require comprehensive collection of information concerning the costs of bait harvesting, if accuracy is desired in this estimation. Alternatively, analysts are left to approximate total bait costs through proxies for the cost of catching bait and bait usage from vessels that purchase their bait. Similarly, many of the shore based processors deploy crews as needed to process groundfish and crab. Company housing is often provided, along with meals and other support services. The costs of labor associated with crab fisheries must be apportioned from these labor and labor support costs. An analyst will have an incomplete understanding of the operations, if the method of apportionment and influences of other fisheries on crab labor choices are not considered. Complete consideration of these factors likely requires an understanding of the timing and labor demands of those other fisheries. To fulfill the original objectives of the data collection (such as estimation of quasi-rents) would require that these elements be fully and consistently reported.⁴

Development of data collection revisions

The Council could consider developing the scope of the data collection based on two major considerations. First, the Council could consider whether to maintain reporting at the individual fishery level or pursue a more expansive approach that collects data at a more aggregate level across either all crab fisheries or all activities of a vessel or plant. The current collection focuses in large part on individual crab fishery information, but collects some information concerning all crab fisheries activity and other data at the vessel and plant level (which support operations in all fisheries and activities). A broader scoped program could be structured to collect data from all crab fisheries activity or activity in all fisheries, as opposed to only data from individual crab fishery operations (or fishery level data). If the broadest collection is adopted, data concerning all vessel/plant costs are collected. Depending on the data characteristics and the potential detail of other available data, analysts may use these data in one of two ways. First, the data may be used to examine the operations of the vessel/plant in its entirety. For example, plant crew data collected for all fisheries would allow analysts to examine the compensation of crew in all activities (rather than only crab activities). This broader activity estimate might be more informative of overall plant effects, in cases where separation of crab fishery impacts are either infeasible or incomplete. This may be the case for elements such as processing employment, particularly at plants that move workers between groundfish and crab lines as landings flow through the plant. Estimates of crab processing employment or labor alone are likely incomplete descriptions of the workforce and may inaccurately characterize crab fishery effects, given the interplay and interdependence of the plant on groundfish and crab processing. Alternatively, analysts may be able to statistically apportion costs across the various fisheries in which a vessel/plant operates to derive approximate measures of costs associated with a particular fishery. Whether an analyst could accurately apportion the data would depend on the level of detail of data used to construct the proxy measure (e.g. using days fishing or pounds processed to pro-rate costs by fishery), as well as the nature of the data collected and the operations. It might be possible to apportion certain input costs between fisheries, if other elements accurately support the disaggregation.

³ These inaccuracies and inconsistencies arise from a variety of sources. In some instances, the questions in reporting forms assume a different structure of industry operations and recordkeeping. These misunderstandings arise not only from a misunderstanding of the industry during the data collection program development, but also from changes in the industry brought on by the rationalization program.

⁴ Additional aspects of the current program that influence the accuracy, cost of collection, and utility of the collected data more broadly are the validation audit process and the "blind" format that analysts are limited to when using the data. Both of these aspects are mandated by current regulation. Arguably beyond the scope of this discussion paper, these aspects of the program could be identified by the Council for consideration in the analysis of program changes.

Development of a broad-based data collection program that collects data at the vessel and plant level could build on the experiences from the existing data collection and would be consistent with the approach adopted in the Amendment 80 data collection. Taking this approach, some elements that are problematic would need restructuring and revisions. For example, in the current collection, vessel expenditures may be reported as either “investments” or “repairs and maintenance” depending on an accounting choice of the vessel owner. Efforts could be undertaken to establish a more consistent means of reporting these elements. Also, a portion of most vessels’ fuel purchases are not used in the year of purchase. The degree of this spillover and the effects on uses of the data would need to be more fully understood. This approach to data collection might facilitate the broad scope of analyses suggested by the Council’s original motion concerning data collection. Yet, the ability of analysts to achieve the goals suggested in the Council’s original motion through more aggregate reporting could be limited to the extent that information is not available to support statistically acceptable and accurate disaggregation.⁵

The Council could also consider defining its data collection program by focusing its collection on certain elements that provide particularly relevant information concerning fishery operations and their effects, as well as the effects of management actions on those operations. This approach would eliminate the collection of data elements that are less informative of operations, but which might be desirable for more all-encompassing analyses, such as estimating profits. This approach might be intended to reduce the burdens associated with data submission, while still providing improved information concerning the certain aspects fisheries operations and their effects. The collection, however, would not support some of the more expansive analyses that might be possible with a broader data collection program.

The two approaches could be integrated to some degree, if the Council were to elect to collect certain data at the crab fishery level (such as crew compensation) and other data on a broader basis (such as annual fuel purchases). In pursuing any of these paths, the Council should clearly identify its objectives through its purpose and need statement. The purpose and need statement should identify the Council’s rationale for undertaking an action revising the data collection. That purpose and need statement could identify the importance of improved information concerning fishery operations and the effects of management actions on those operations (which is the purpose for economic data collection, generally). The purpose and need statement could go on to identify the difficulties with accuracy and consistency in the existing data collection as the basis for modifying the program. Depending on the Council’s choice for addressing that problem, the Council could adopt a purpose and need statement that directs the data collection toward either 1) a broad scope data collection program that includes more complete information concerning all activities of vessels and plants that participate in the crab fisheries, 2) a more limited scope data collection that includes only crab fishery information (but aggregated across all crab fisheries), or 3) a more focused collection of data from each crab fishery.

⁵ For example, disaggregation of fuel use data across fisheries will not be feasible, if data are not collected concerning all vessel activities (such as activities in other fisheries, transiting, and tendering). Without detailed information concerning these operations, analysts would certainly be unable to disaggregate these data.

| | | Fishery information level | | |
|----------------------------|--------------------------|---|---|--|
| | | By individual crab fishery | <u>Crab fishery only</u> | <u>All fisheries</u> |
| Economic information level | <u>Critical elements</u> | Critical operational components in the crab fisheries | Critical operational components in the crab fisheries | Critical operational components pertinent to activities in all fisheries |
| | <u>All elements</u> | All operational components in the crab all fisheries | All operational components in the crab fisheries | All operational components in all fisheries |

In considering these two factors in defining the scope of the data collection program, the Council should consider the extent to which any data would suffer from inaccuracy, imposes excessive submission costs, and duplicates existing data collection. While some elements in the current data collection are informative and can be efficiently submitted with high quality, others are not reported accurately. Still, others have been identified by industry as excessively costly. In addition, some duplicate existing data collection efforts. In considering the revisions to the data collection effort under this action, the Council should assess these factors with respect to each data element and determine a reasonable tradeoff between the additional information that will be gained by including the element in the data collection and the additional burden associated with the reporting. This assessment should include consideration of the most efficient source of the desired information and the potential for redistributing reporting requirements from vessel and plant owners to different entities. In assessing the information, the Council should consider both the accuracy of the reporting that can be expected from current data submitters as well as alternative data providers, and the extent to which the element gives insights that are otherwise unattainable through other data that are currently collected.

Although assessing these various factors may seem straightforward, the effect of different data collections on the ability of analysts to provide information to the Council may not always be obvious. Certain economic analyses may require specific economic data. In particular, cost data may be required to perform analyses of capacity utilization, productivity and production efficiency, quasi-rents, rents, cost minimization, and profits. As cost data are omitted from the collection, the ability of analysts to develop these analyses will be limited. For example, pot registration and pot pull information provide measures of the use of pots by vessels in the fleet. Yet, these data cannot be directly substituted for pot purchases in most economic models. Generally speaking, rent models require the most comprehensive data (including fixed cost data). Omitting fixed cost data, quasi-rent models (which omit fixed costs) and cost minimization models (which omit revenue information and may omit fixed costs) may still be estimated with relatively comprehensive variable cost data. As variable cost data are scaled back the ability of analysts to perform these analyses will also be compromised. In determining whether to forgo collection of certain elements, the Council should consider the degree to which its decision may limit these analytical abilities.

Although analysts may be limited in the extent of the models that can be estimated with omission of critical data elements, if all important indicator variables are included, it may be possible to gain insights from carefully specified models. For example, a program that includes collection of fuel data, crew data, and other important variable cost inputs may still allow modeling of quasi-rents, if only variable cost

elements of minor importance or little variability are omitted. Such variables might include vessel freight costs (which have been minimal and infrequent under the program). Much of the data currently collected, however, is necessary for these modeling exercises. In short, the potential that the data collection may prevent analysts from estimating these more powerful economic models must be considered.

As a consequence of these potential limitations, should the Council consider a scaled-back data collection program, the development of reasonable means of obtaining these data in the future should be considered. For important data elements, the Council could consider the development of a process to ensure that these data may be later incorporated into the data collection program. A process could be identified for extending the program to collect these variables, once specific, identified Council concerns are met. This process could be used to ensure that the Council benefits from these more informative models, as soon as those data can be accurately and cost effectively collected to its satisfaction.

As a part of this process, the Council could prioritize variables of greatest interest. For example, the Council believes that additional information concerning pot purchase and use arrangements would be beneficial to its understanding of the rationalization program (or possible future management changes), it could identify the structure of pot markets and sharing arrangements as a priority area for study for future extensions of the data collection program. This type of prioritization would allow for the most efficient and effective use of staff resources. The Council could also consider a pilot collection program with more intensive validation to collect certain of these elements. The program could be focused on elements that are high priority and that are believed to have a reasonable level of accuracy. Such a program could be developed simultaneously with the modification to the data collection program revisions or as a separate project. Extensions of the collection to additional elements could be undertaken as methods are developed for ensure that the submissions will be informative, accurate, and cost effective.

Conclusion

The Council has expressed its intention to revise the economic data collection reporting requirements that apply to participants in the crab rationalization program. This paper sets out background information that the Council could use to initiate that process. The starting point for the process is development of a purpose and need statement defining the Council's objectives for collecting economic data from fishery participants. The Council's motion specifically requested that this paper include a description of its original purpose and need statement. The Council may wish to draw from that purpose and need statement in considering the development of a purpose and need statement for this action. The Council also requested a review of the existing data collection that specifically assessed the accuracy, cost of collection, and information value. The Council could adapt these considerations, in a manner that identifies their relative importance, for inclusion in its purpose and need statement. In considering the appropriate scope and purpose of its data collection program, the Council should consider the effects of those scoping decisions on potential analyses that could be undertaken. For example, narrower data collection programs that exclude certain cost items may not support some analyses of rents, quasi-rents, and efficiency changes in the fisheries. Identifying the scope of the data collection program

Appendix 1 – June 2002 data collection motion

In June 2002, early on in the development of the crab economic data collection program, the Council adopted the following motion concerning data collection:

The North Pacific Fishery Management Council and the National Marine Fisheries Service shall have the authority to implement a mandatory data collection program of cost, revenue, ownership and employment data upon members of the BSAI crab fishing industry harvesting or processing fish under the Council's authority. Data collected under this authority will be maintained in a confidential manner and may not be released to any party other than staffs of federal and state agencies directly involved in the management of the fisheries under the Council's authority and their contractors.

A mandatory data collection program shall be developed and implemented as part of the crab rationalization program and continued through the life of the program. Cost, revenue, ownership and employment data will be collected on a periodic basis (based on scientific requirements) to provide the information necessary to study the impacts of the crab rationalization program as well as collecting data that could be used to analyze the economic and social impacts of future FMP amendments on industry, regions, and localities. This data collection effort is also required to fulfill the Council problem statement requiring a crab rationalization program that would achieve "equity between the harvesting and processing sectors" and to monitor the "...economic stability for harvesters, processors and coastal communities". Both statutory and regulatory language shall be developed to ensure the confidentiality of these data.

Any mandatory data collection program shall include: A comprehensive discussion of the enforcement of such a program, including enforcement actions that would be taken if inaccuracies in the data are found. The intent of this action would be to ensure that accurate data are collected without being overly burdensome on industry for unintended errors.

The Council adopted a follow up motion in February 2003, which added specificity to its earlier motion:

The mandatory data collection program shall have the following elements (from the February 2003 motion):

- A. Purpose. The purpose of the data program is as set out in the June 2002 motion. The Council will require the production of data needed to assess the efficacy of the crab rationalization program and to determine its relative impact on fishery participants and communities.
- B. Type of data to be collected. The data collected shall be that needed to achieve the Council's purpose, with the following general guidelines:
 1. The information will be specific to the crab fisheries included in the crab rationalization plan.
 2. The data shall include information on costs of fishing and processing, revenues for harvesters and processors, and employment data
 3. The general guide for information requirements will be as set out in the draft surveys prepared by National Marine Fisheries Service dated 9/18/02, except
 - a) Non-variable costs shall be collected only as needed to explain and analyze variable cost data.
 - b) Collect a unique identifier for harvesting and processing crew members to explain changes in participation patterns as requested by the AP
 4. Historical information will be required as recommended by the Data Collection Committee.
- C. Method of Collection. Data shall be submitted to an independent third party agent such as the Pacific States Marine Fisheries Commission.
- D. Use of data. Data will be used following these general guidelines:
 1. Data shall be supplied to Agency users in a blind and unaggregated form.
 2. The agencies will develop a protocol for the use of data, including controls on access to the data, rules for aggregation of data for release to the public, penalties for release of confidential data, and penalties for unauthorized use.

3. The agencies will revise the current Memorandum of Understanding governing the sharing of data between the State of Alaska and National Marine Fisheries Service, and will address in this MOU the role of the third party data collection agent.
 4. The Agency and Council will promote development of additional legislative and regulatory protection for these data as needed.
- E. Verification of Data. The third party collection agent shall verify the data in a manner that assures accuracy of the information supplied by private parties.
- F. Enforcement of the data requirements. The Council endorses the approach to enforcing the data requirements developed by the staff and the Data Collection Committee, as set out on page 3.17-20 in the February, 2003 document entitled "BSAI Crab Rationalization Program, Trailing Amendments", which provides:

Anticipated Enforcement of the Data Collection Program The analysts anticipate that enforcement of the data collection program will be different from enforcement programs used to ensure that accurate landings are reported. It is critical that landings data are reported in an accurate and timely manner, especially under an IFQ system, to properly monitor catch and remaining quota. However, because it is unlikely that the economic data will be used for in-season management, it is anticipated that persons submitting the data will have an opportunity to correct omissions and errors³⁷ before any enforcement action would be taken. Giving the person submitting data a chance to correct problems is considered important because of the complexities associated with generating these data. Only if the agency and the person submitting the data cannot reach a solution would the enforcement agency³⁸ be contacted. The intent of this program is to ensure that accurate data are collected without being overly burdensome on industry for unintended errors.

A discussion of four scenarios will be presented to reflect the analysts understanding of how the enforcement program would function. The four scenarios are 1) a case where no information is provided on a survey; 2) a case where partial information is provided; 3) a case where the agency has questions regarding the accuracy of the data that has been submitted; and 4) a case where a random "audit" to verify the data does not agree with data submitted in the survey.

In the first case, the person required to fill out the survey does not do so. In the second case, the person fills out some of the requested information, but the survey is incomplete. Under either case that person would be contacted by the agency collecting the data and asked to fulfill their obligation to provide the required information. If the problem is resolved and the requested data are provided, no other action would be taken. If that person does not comply with the request, the collecting agency would notify enforcement that the person is not complying with the requirement to provide the data. Enforcement would then use their discretion regarding the best method to achieve compliance. Those methods would likely include fines or loss of quota and could include criminal prosecution.

In the third case the person fills out all of the requested information, but the agency collecting the data, or the analysts using the data, have questions regarding some of the information provided. For example, this may occur when information provided by one company is much different than that provided by similar companies. These data would only be called into question when obvious differences are encountered. Should these cases arise, the agency collecting the data would request that the person providing the data double check the information. Any reporting errors could be corrected at that time. If the person submitting the data indicates that the data are accurate and the agency still has questions regarding the data, that firm's data could be "audited". It is anticipated that the review of data would be conducted by an accounting firm selected jointly by the agency and members of industry. Only when that firm refuses to comply with the collecting agencies attempts to verify the accuracy of the data would enforcement be contacted. Once contacted, enforcement would once again use their discretion on how to achieve compliance.

³⁷The intent of the program is to have enforcement actions triggered by the willful and intentional submission of incorrect data or noncompliance with the requirements to submit data.

³⁸The term enforcement agency in this case may or may not include the RAM Division and the Office of Administrative Appeals (in addition to NMFS Enforcement). Those details are still under discussion within NOAA.

The fourth case would result when the "audit"³⁹ reports different information than the survey. The "audit" procedure being contemplated is a verification protocol similar to that which was envisioned for use in the pollock data collection program developed by NMFS and PSMFC. During the design of this process, input from certified public accountants was solicited in order to develop a verification process that is less costly and cumbersome than a typical "audit" procedure. That protocol involves using an accounting firm, agreed upon by the agency and industry, to conduct a random review of certain elements of the data provided⁴⁰.

Since some of the information requested in the surveys may not be maintained by companies and must be calculated, it is possible that differences between the "audited" data from financial statements and survey data may arise. In that case the person filling out the survey would be asked to show how their numbers were derived⁴¹. If their explanation resolves the problem, there would be no further action needed. If questions remained, the agency would continue to work with the providers of the data. Only when an impasse is reached would enforcement be called upon to resolve the issue. It is hoped that this system would help to prevent abuse of the verification and enforcement authority.

In summary, members of the crab industry will be contacted and given the opportunity to explain and/or correct any problems with the data, that are not willful and intentional attempts to mislead, before enforcement actions are taken. Agency staff does not view enforcement of this program as they would a quota monitoring program. Because these data are not being collected in "real" time, there is the opportunity to resolve occasional problems as part of the data collection system. Development of a program that collects the best information possible to conduct analyses of the crab rationalization program, minimizes the burden on industry, and minimizes the need for enforcement actions are the goals of the data collection initiative.

³⁹This "audit" could be the result of either the random review process that is contemplated or an "audit" triggered under scenario three.

⁴⁰However, in cases of non-compliance in which enforcement has to be notified, the data verification process is likely be more comprehensive.

⁴¹Any time a number must be derived, the survey will provide direction on how to calculate the information requested. This direction should help minimize differences. However, when discrepancies do arise, the firm will be given an opportunity to show how they derived their figures, and correct the information if necessary.

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Oct 2010

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SSL Research needs: Response to request from NPFMC:

While the western population of Steller sea lion (SSL) has increased in abundance over the last ten years, the overall rate of recovery, as well as the pattern of recovery by sub-regions is not consistent with the existing guidelines for delisting criteria. Specifically, the numbers of SSL are in decline or stable in three of the seven sub-regions (i.e., western Aleutian Islands, central Aleutian Islands, and the central Gulf of Alaska).

Unfortunately, the only sub-region where SSL numbers are in a statistically significant decline is also the sub-region that has greatest information gaps regarding vital rates and foraging ecology. Current information on foraging ecology is also lacking for the other two sub-regions where sea lion numbers are not increasing at statistically significant rates (i.e., central Aleutians and central Gulf of Alaska). Also, because studies suggest sea lions on the Commander Islands are genetically more similar to those in Alaska than to other rookeries in Russia, additional research to close information gaps also includes studies within the Russian portion of the population.

Existing federal appropriations for the SSL research is insufficient to expand on-going population monitoring studies by NMFS and other research institutes. The NPFMC has requested NMFS provide the Council with a list of research projects that would address these information gaps. The following list is intended to be responsive to the request of the Council.

Finally, the Council is aware that the North Pacific Research Board intends to announce through the release of a Request for Proposals in the next 30 days, an opportunity for funding some of the research projects listed below.

Marine mammals:

1. Foraging ecology studies of SSL in the western and central Aleutians. Specifically, this research would include at-sea tracking of adult females and juveniles, and collecting SSL scat and spew. Supplemental research could include stable isotope analyses, fatty acid analysis, contaminant studies, monitoring of condition and health indices, and additional photogrammetric work.
2. Foraging ecology studies of SSL in the Commander Islands. Research techniques would be similar to item #1.
3. Foraging ecology studies of SSL in the Gulf of Alaska. In addition to at-sea tracking of older animals, outside of the Kodiak area the primary information needed from this sub-region is updated information on diet composition of SSL throughout the sub-region.
4. Studies to assess vital rates (i.e., reproduction and survival) of SSL in the western and central Aleutians. Specifically, this would require longitudinal studies (e.g., branding of pups) to determine rates of age- or size-class specific survival, as well as studies to help evaluate the reproductive performance of adult females.

5. Maintain assessment of SSL vital rates in the Russian Far East and Commander Islands. Research techniques would be similar to item #4 and include expansion to autumn and winter periods.
6. Aerial photogrammetric survey studies of rookeries and haul-outs in Russia. This survey methodology would provide abundance estimates for sea lions in Russia directly comparable to estimates for Alaska.
7. Studies investigating advancements in methods to estimate sea lion abundance, such as the use of unmanned aerial vehicles, that would increase the probability of acquiring abundance estimates in remote areas.
8. Studies to improve understanding of killer whale predation of SSLs, particularly in the western and central Aleutian Islands.

Fish:

1. Winter surveys of groundfish in all three areas (EBS, GOA and AI) to create seasonal models of fish biomass distribution relative to CH
2. Tagging studies of Pacific cod and Atka mackerel to create models of short-term movement of fish relative to CH (tagging methods for pollock are in development)
3. Tagging studies of Atka mackerel to estimate local abundance inside and outside CH
4. Food habits collections and ecosystem modeling to quantify interactions between SSL groundfish prey and the food web effects of changes in fishing mortality
5. Modeling and field studies of ecosystem productivity in different regions (EBS, GOA and AI)
6. Focal studies of SSL foraging behavior, SSL diet, fish abundance, fish movement, oceanography, ocean productivity and fisheries impacts in contrasting areas of SSL population trend in the Aleutian Islands (including the Commander Islands) and in areas where SSL forage. These studies would be conducted in summer and winter. Fish abundance estimates would be from trawling, acoustics, tagging, pots and/or camera surveys depending on the species and habitat. AFSC standard trawl surveys are not appropriate for assessing fish biomass distribution at local scales important to SSL.

It is assumed that on-going research to monitor population trends (biennial surveys) and fish biomass, as well as on-going, long-term field camps would be continued with existing funding levels.

September 2010 Joint Groundfish Plan Team Recommendations to
North Pacific Fishery Management Council
Five-Year Research Priorities, 2010-2014/2011-2015
Adopted October 2009

Based on recommendations from its scientific committees, the Council has identified priorities for research in the next one to five years as those activities that are the most important for the conservation and management of fisheries in the Gulf of Alaska, Aleutian Islands and the eastern Bering Sea. This listing of priorities is intended for two purposes: 1) to meet the requirements of the revised Magnuson-Stevens Act for the Councils to identify research that is needed in the next 5 years, and 2) to provide guidance on research priorities to the research community and to funding agencies.

Immediate Concerns

I. Fisheries

A. Fish and Fisheries Monitoring

1. Non-recovering crab stocks. A pressing issue is why some crab stocks have declined and failed to recover as anticipated (e.g., Kodiak red king crab, Pribilof Island blue king crab, Adak red king crab). Research into all life history components is needed to identify population bottlenecks, an aspect that is critically needed to develop and implement rebuilding plans.
2. Continue efforts to design and implement an improved observer delivery program that allows accurate and precise estimation of the catch by season and sector, including expansion of the program to previously unobserved vessels. (Also see Strategic Priority II.A.1).
3. Improvements are needed in in-season catch accounting for crab in non-directed fisheries with high incidental catch rates.
4. Improve species identification in catches by both processors and observers for priority species within species complexes. Methods that quantify and correct for misidentifications are desired.
4. Develop/investigate methods for reliable estimation of total removals (e.g., surveys, poorly observed fisheries) to meet requirements of total removals under ACLs.

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B. Stock Assessment

1. Develop a size-based stock assessment model of Tanner crab in order to provide appropriate scenarios for evaluating and selecting a rebuilding strategy.
2. Improve handling mortality rate estimates for crab. Improved understanding on the post-release mortality rate of discarded crab from directed and non-directed crab pot fisheries and principal groundfish (trawl, pot and hook and line) fisheries is required. The magnitude of post-release mortality is an essential parameter used in the determination of total annual catch used to evaluate overfishing and in stock assessment and projection modeling. For example, assess discard mortality rates of Tanner crab by size, month, sex, and fishery type.
2. Refine methods to incorporate uncertainty into harvest strategies for groundfish, crab, and scallops for ACL estimation.

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C. Fishery Management

1. Analyses are needed of the ability of pollock harvesters to adapt their behavior to avoid Chinook and other salmon bycatch under various economic and environmental conditions and incentive mechanisms.
2. ~~An evaluation is needed of economic effects from the recently adopted crab rationalization program on Gulf of Alaska coastal communities, including Kodiak. This includes understanding the economic impacts (both direct and indirect impacts) and how the impacts are distributed among communities and economic sectors; conducting qualitative research to assess changes in community participation and effort in fisheries; and estimating net economic benefits.~~
3. ~~As Kodiak is likely to be at the center of controversy over the probable consequences of Gulf rationalization, research should be designed to use Kodiak in addition to other Gulf communities as a case study in prospective analyses of the potential effects of Gulf rationalization options on fishing behavior, participation, and economic impacts.~~

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II. Fisheries Interactions

A. Protected species

1. There is a need for studies of localized fishery-protected species interactions. Whereas global fishery control rules may generally prevent overfishing on a broad regional basis, non-random patterns of fishing may cause high rates of removals in local areas important to apex predators such as Steller sea lions, ice seals, northern fur seals, spectacled eider, Steller's eider, and short-tailed albatross. More studies are needed to fully evaluate potential local effects of fishing on other components of the ecosystem (e.g., marine mammals, seabirds, and the impact on benthic habitat and fauna) by bottom contact gear.
2. Further research is needed on gear modifications and fishing practices for reducing bycatch, particularly of PSC species (e.g., salmon, crab).
- 2.3. Investigate interactions between whales and surveys and fisheries and develop population estimates of major whale species.

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III. Habitats

A. Evaluate habitats of particular concern:

1. Assess whether Bering Sea canyons are habitats of particular concern by assessing the distribution and prevalence of coral and sponge habitat, and comparing marine communities within the canyon areas, including mid-level and apex predators (such as short-tailed albatrosses) to neighboring shelf/slope ecosystems.
2. ~~Assess the extent, distribution, and abundance of important skate nursery areas in the BBS to evaluate the need for designation of new HAPCs.~~

B. Baseline Habitat Assessment

1. Dynamic ecosystem and environmental changes, on a pace not observed in recorded time, are occurring in the northern Bering Sea and Arctic. Given the potential for fishery expansion into the northern Bering Sea, as well as considerations associated with establishment of the new FMP for

the Arctic. assessment of the current baseline conditions is imperative. This effort should not supplant the regular surveys in the BSAI and GOA, which are of critical importance.

Ongoing Needs

I. Fisheries

A. Fish and Fishery Monitoring

1. Continuation of State and Federal annual and biennial surveys in the GOA, AI and EBS, including BASIS surveys and crab pot surveys, is a critical aspect of fishery management off Alaska. It is important to give priority to these surveys in light of recent proposed federal budgets in which funding may not be sufficient to conduct these surveys. These surveys provide baseline distribution, abundance, and life history data that form the foundation for stock assessments and the development of ecosystem approaches to management. These surveys are considered the highest priority research activity contributing to assessment of commercial groundfish fisheries off Alaska.
2. Continue to plan and implement routine surveys into the northern Bering Sea and conduct baseline surveys of the Arctic Ocean. These surveys will become increasingly important under ongoing warming ocean temperatures, because range expansions of harvested fishery resources are anticipated. If range expansions occur, data will be needed to adjust standard survey time series for availability.
3. Continue and expand cooperative research efforts to supplement existing surveys to provide seasonal or species-specific information for use in improved assessment and management. The SSC places a high priority on studies that provide data to assess seasonal diets and movements of fish and shellfish for use in studies of species interactions in spatially explicit stock assessments.
4. For groundfish in general, and rockfish in particular, continue and expand research on trawlable and untrawlable habitat, to improve resource assessment surveys. For example, improved surveys, such as hydro-acoustic surveys, are needed to better assess pelagic-rockfish species that are found in untrawlable habitat or are semi-pelagic species such as northern and dusky rockfish, including GOA POP stocks.
5. Studies are needed to evaluate the effects of environment on survey catchability. For crabs, studies are needed on catchability as it directly bears on estimates of the stock size for setting of catch quotas. Research to refine the estimates of survey catchability, q , used to infer absolute, rather than relative abundance, would substantially improve the quality of management advice. Particular emphasis should be placed on snow and Tanner crab because of recent trends in stock status.
6. Continue research on the design and implementation of appropriate survey analysis techniques to aid the Council in assessing species that exhibit patchy distributions and, thus, may not be adequately represented (either over or under estimated) in the annual or biennialbiannual groundfish surveys.
7. There are needs to improve biological data collection (e.g., age, size, maturity, and sex) of some bycatch species (e.g., sharks, skates, octopus, squid, sculpins, and grenadiers) to better quantify potential effects of bycatch on these stocks.
8. Advance research towards developing a quantitative female reproductive index for the surveyed BSAI crab stocks. The current stock-status assessment process for surveyed BSAI crab stocks

uses the estimated mature male biomass at the presumed time of mating as the best available proxy for fertilized egg production. Research on mating, fecundity, fertilization rates, and, for snow and Tanner crab, sperm reserves and biennial spawning is needed to develop annual indices of fertilized egg production that can be incorporated into the stock assessment process and to model the effects of sex ratios, stock distribution, and environmental change on stock productivity. Priority stocks for study are eastern Bering Sea snow and Tanner crab and Bristol Bay red king crab.

9. Continue and expand existing efforts to collect maturity scans during fisheries that target spawning fish.
10. Identification and recovery of archived data (e.g., historical agency groundfish and shellfish surveys) should be pursued. Investigate integrating these data into stock and ecosystem assessments.

B. Stock Assessment

- ~~1. Refine methods to incorporate uncertainty into harvest strategies for groundfish, crab, and scallops for ACL estimation.~~
- 2.1 Improve information (specifically, natural mortality, size at maturity, and other basic indicators of stock production/productivity) for sharks, skates, sculpins, octopus, and squid~~“other species”~~ and data-poor stocks of crab to allow application of Tier 5 or Tier 4 assessment criteria. Two possibilities that would require dedicated research for development are: (1) directly estimate fishing mortalities through large-scale tagging programs; and (2) habitat-based estimates of abundance based on local density estimates in combination with large-scale habitat maps. Little information is available, especially for sculpins, skates, octopuses, squids, grenadiers, and some sharks.
- 2.2 ~~Collect data to improve~~Improved estimates of natural mortality (M)-estimates. Estimates of M (obtained independently from models) are needed for several stocks, including Pacific cod and BSAI crab stocks.
- 3.3 Studies are needed to validate and improve age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish.
- 5.4 Quantify the effects of historical climate variability and climate change on recruitment and growth and develop standard environmental scenarios for present and future variability based on observed patterns. There is also a clear need for information that covers a wider range of seasons than is presently available.
- ~~6.5 There is a need for the development of advanced stock assessment modeling techniques. Specifically, there is a pressing need to develop techniques for linking uncertainty into stock assessments, including both scientific uncertainty (measurement error, process error or model misspecification) and implementation error (enforcement and catch monitoring).~~
- 7.6 There is a need for the development of projection models to evaluate the performance of different management strategies relative to the Council’s goals for ecosystem approaches to management. Projection models are also needed to forecast seasonal and climate related shifts in the spatial distribution and abundance of commercial fish and shellfish (see Strategic Priority IV.A.1.a “Climate variability” below for more detail).
8. To identify stock boundaries, expanded studies are needed in the areas of genetics, reproductive biology, larval distribution, and advection. Expanded tagging efforts are needed to support the development of spatially explicit assessments. High priority species for spatially explicit models include: walleye pollock, Pacific cod, sablefish, yellowfin sole, rock sole, arrowtooth flounder, Pacific ocean perch, black spotted and rougheye rockfish, and Atka mackerel (see element 5 in

Expanded Ecosystem Studies below). Specific issues include: a) an evaluation of the location of potential boundaries for an AI—EBS split that would be needed to assess the implications of the creation of a separate Aleutian Island management area, and b) stock delineation for estimation of adult equivalence to appropriately account for the impact of incidental catches of salmon in pollock fisheries on salmon populations.

Determine if discrete scallop beds along the GOA coast from Lituya Bay to Kodiak Island are reproductively isolated units or if upstream areas are a significant source of scallop recruitment via larval advection and subsequent settlement in downstream areas.

10. Continue whale depredation studies to improve the quality of longline survey estimates.

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C. Fishery Management

1. Evaluate the effectiveness (e.g., potential for overharvest or unnecessarily limiting other fisheries) of setting ABC and OFL levels for data-poor stocks (Tier 5 and 6 for groundfish and Tiers 4 and 5 for crab) (e.g., squid, octopus, shark, sculpins, other flatfish, other rockfish, skates, grenadier, and crab). Research is needed to refine the basis for setting gamma for Tier 4 crab stocks.
2. Develop forecasting tools that incorporate ecosystem indicators into single or multispecies stock assessments to conduct management strategy evaluations under differing assumptions regarding climate and market demands. Standardization of "future scenarios" will help to promote comparability of model outputs.
3. Development of an ongoing database of product inventories (and trade volume and prices) for principal shellfish, groundfish, and salmon harvested by U.S. fisheries in the North Pacific and Eastern Bering Sea.
4. Analyze current determinants of exvessel, wholesale, international, and retail demands for principal seafood products from the GOA and BSAI.
5. Conduct pre- and post-implementation studies of the benefits and costs, and their distribution associated with changes in management regimes (e.g., changes in product markets, characteristics of quota share markets, changes in distribution of ownership, changes in crew compensation) as a consequence of the introduction of dedicated access privileges in the halibut/sablefish, pollock, and crab fisheries. "Benefits and costs" include both economic and social dimensions.
6. Conduct prospective analyses of the robustness and resilience of alternative management strategies under varying environmental and ecological conditions.
7. Conduct prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management actions (e.g., time/area closures, marine reserves, bycatch restrictions, co-ops, IFQs).
8. Develop a framework for collection of economic information on commercial, recreational, and charter fishing, as well as fish processing, to meet the requirements of the MSFCMA sections 303(a)(5, 9, 13), 303(b)(6), and 303A.
9. An evaluation is needed of economic effects from the recently adopted crab rationalization program on Gulf of Alaska coastal communities, including Kodiak. This includes understanding the economic impacts (both direct and indirect impacts) and how the impacts are distributed among communities and economic sectors; conducting qualitative research to assess changes in community participation and effort in fisheries; and estimating net economic benefits.
8. As Kodiak is likely to be at the center of controversy over the probable consequences of Gulf rationalization, research should be designed to use Kodiak in addition to other Gulf communities as a case study in prospective analyses of the potential effects of Gulf rationalization options on fishing behavior, participation, and economic impacts

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II. Fisheries Interactions

A. Catch Estimation Issues

1. Improve estimation of catch of and other fishery interactions with marine mammals (e.g., state-managed gillnet fisheries), seabirds, non-target groundfish (e.g., sharks, skates) and crab, and protected species. Improved methods should include direct and alternative monitoring options (e.g., electronic logbooks, video monitoring), particularly on smaller groundfish, halibut, and commercially guided recreational fishing vessels.

B. Protected Species Interactions

1. Population dynamics, life history, and assessment of protected species, particularly Steller sea lions and northern fur seals, are a high priority. In particular, investigation of factors contributing to changes in natality of Steller sea lions is an important area of research.
2. Economic, social, and cultural valuation research on protected species (i.e., non-market consumptive use, passive use, non-consumptive use).

III. Habitat

A. Habitat Mapping

1. Improved habitat maps (especially benthic habitats) are required to identify essential fish habitat and distributions of various substrates and habitat types, including habitat-forming biota, infauna, and epifauna.
2. Begin to develop a GIS relational database for habitat, including development of a historical time series of the spatial intensity of interactions between commercial fisheries and habitat, which will be needed to evaluate impacts of changes in EFH on the growth, reproduction, and distribution of fish and shellfish.
3. Assess the extent of the distribution of *Primnoa* corals in the GOA.

B. Function of Habitat

1. Evaluate relationships between, and functional importance of, habitat-forming living substrates to commercially important species, including juveniles.
2. Develop a time series of the impact of fishing on GOA, AI, and EBS habitats that could be used to assess: a) the impact of changes in management on the rate of habitat disturbance, and b) the impact of habitat disturbance on the growth, distribution, and reproductive success of managed species.
3. Evaluate effects of fishing closures on benthic habitats and fish production. There are many closures that have been in effect for various periods of time for which evaluations have not been conducted. A recent example includes slope HAPCs designated in the western Gulf of Alaska.

IV. Other areas of Research Necessary for Management

A. Expanded Ecosystem Studies

1. Ecosystem indicator development and maintenance: existing ecosystem indicators need to be routinely updated and maintained. These include, but are not limited to

a) Climate and physical time series (EBS cold pool volume, etc)

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b) Low trophic level community production data

(1) Primary production time series appropriate to the scale of managed areas (EBS, AI, GOA) need to be developed

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(2) Zooplankton production and biomass time series for the EBS need to be maintained. Series for the AI and GOA need to be developed that are appropriate to regional groundfish management scales

(3) Zooplankton community composition time series should be maintained and refined in the EBS and developed for the AI and GOA

(4) Benthic community composition, production, and biomass time series need to be developed for all managed areas. This could interface with habitat work.

c) Developing basic research needs below into indicator series for single species and ecosystem SATEs

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2. Ecosystem indicator synthesis research (combined indicators, thresholds, management objectives)

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3.

Basic research on specific topics (reword below to make into research)

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2.3.4 Environmental influences on ecosystem processes

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a) Climate variability: Changes in ocean temperature may affect managed species, upper level predators, and lower trophic levels.

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(1) Maintain moorings: Sea ice: If recent changes in ice cover and temperatures in the Bering Sea persist, they may have profound effects on marine communities. Development and maintenance of indices of the timing and extent of the spring bloom is a high priority. For this, maintenance of moorings, especially M-2, is essential.

(2) Measure and monitor zooplankton production: Apparent declines in zooplankton wet weight over the shelf, measured by the Oshoro Maru, could imply the loss of critical copepod and euphausiid prey of important commercial species, such as pollock, as well as the ESA listed North Pacific right whale.

(3) NMFS and BSIERP scientists should evaluate EBS survey data collected in 2008 during the summer trawl survey, acoustic surveys, and the BASIS cruises to assess whether these surveys will provide reliable estimates of zooplankton species composition and abundance for the Eastern Bering Sea. Evaluate the potential of collaborative research with Japanese and Russian investigators to assess species composition and abundance in samples archived abroad.

(4) Measure and monitor fish composition: NMFS and BSIERP scientists should complete proposed analysis of existing data sets (bottom trawl surveys, acoustic trawl surveys, and BASIS surveys) to quantify changes in relative species composition of commercial and non-commercial species, identify and map assemblages, and monitor changes in the distribution of individual species and assemblages. Additional monitoring may be necessary in the Aleutian Islands and other areas of the Gulf of Alaska.

(5) Assess the movement of fish, to understand the spatial importance of predator-prey interactions in response to environmental variability.

-----Conduct research on Ocean acidification: assess whether changes in pH may would affect managed species, upper level predators, and lower trophic levels.

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4. Basic research on trophic interactions.

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a) Collect, analyze and monitor Diet information, from seasons in addition to summer, is needed to assess spatial and temporal changes in predator-prey interactions, including marine mammals and seabirds. The diet information should be collected on the appropriate spatial scales for key predators and prey to determine how food webs may be changing in response to shifts in the range of crab and groundfish.

b) Ecosystem structure studies: Studies are needed on the implications of food web interactions of global warming, ocean acidification, and selective fishing. For instance, studies are needed to evaluate selective removal/differential exploitation of some components of the ecosystem (e.g., Pacific cod, pollock, and crab) relative to others (e.g., arrowtooth flounder).