Information Needs and Planning Approach for the Kuskokwim Area Salmon Research Plan

Developed by

The Kuskokwim Fisheries Resources Coalition

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INTRODUCTION

Management of Kuskokwim Area fisheries is complex because of overlapping runs of salmon species, gaps in knowledge of stock assessment and salmon biology, mixed stock harvests, socioeconomic and cultural concerns, a lack of knowledge regarding ecosystem function, and the sheer size of the Kuskokwim Area*. Chinook, coho, chum, sockeye, and pink salmon all return to the Area, and all but pink have been targeted by directed fisheries at some point in the past. The large size of the Area has prevented thorough assessment of aspects such as salmon run timing, stock size, and estimates of differences among stocks. These information gaps prevent understanding of ecosystem function and its effects on salmon biology and production while posing challenges to fishery management by allowing the potential for undesirable situations. These information gaps, coupled with the complexity of the fishery, means that the fishery has historically been managed with a relatively high level of uncertainty.

Commercial and sport fisheries in the Kuskokwim Area (Figure 1) are managed by the Alaska Department of Fish and Game to provide for subsistence needs and an economically viable commercial fishery (5 ACC 07.365; Appendix A). Salmon runs in western Alaska have recently had large and unanticipated declines, beginning in 1997 and continuing through the present (2003). These declines have been coupled with low market prices, resulting in severe harvest restrictions and collapsing fisheries, causing fishing communities to suffer both reduced subsistence and commercial fishing opportunity, and prompting a declaration of disaster by the State of Alaska in 1999. At the same time, funding limitations threaten the continuation of some monitoring and research programs, and have limited new studies needed to examine the causes of the fisheries declines.

The failing salmon runs, declaration of disaster, and troubling funding outlook led to several important fisheries developments in the Kuskokwim Area in the early 2000s. First, heightened concerns about salmon run failures and funding shortfalls inspired the formation of the Kuskokwim Fisheries Resources Coalition (KFRC), a grassroots organization formed from over a dozen stakeholder groups from within the Kuskokwim Area. Comprised of representatives already heavily involved in the salmon fishery and its issues, the KFRC formed to address fisheries issues in the Kuskokwim Area in a cooperative way that would ensure best use of existing funds while increasing their efficiency. Second, in response to the declaration of disaster, funds from the Pacific Coastal Salmon Recovery Program were made available through congressional action for the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYK SSI). The AYK SSI will use these funds to foster expanded fishery research to help understand the causes of the decline of these stocks and to support sustainable salmon management in the A-Y-K region. Third, the KFRC proposed to complement the larger A-Y-K planning process by developing a subregional plan for the Kuskokwim Area that can be part of the larger AYK SSI. This plan, termed the Kuskokwim Area Salmon Research Plan (KASRP), would consist of a comprehensive effort to synthesize existing fisheries data and to identify priority information needed for sustaining salmon populations. Funding was granted from several sources (the federal Office of Subsistence Management, the AYK SSI, the Togiak and Yukon Delta National Wildlife Refuges, and the Bering Sea Fishermen's Association) in 2003.

* As defined in the Glossary

The purpose of this report is to describe three meetings held by the KFRC as part of the initial planning process. These meetings were held in February and March of 2004 to identify and agree on the key information needs that would be part of the overall KASRP, and to design a strategy and timeline to achieve the different components of the Plan. In the course of these meetings, the KFRC identified information deemed critical by both Kuskokwim Area stakeholders and experts from outside the region. The KFRC melded these opinions into an overall hierarchy that consisted of the different categories of information that, after careful consideration, they wished to see addressed in the final plan. Finally, the KFRC refined its overall mission statement, discussed ways in which its planning products could interact with the larger AYK planning process, and identified the best timeline for completing different subsections of the KASRP. The specific items discussed in this report are:

- The approach used by the KFRC during three meetings in February and March 2004 to develop the framework of information needs, evaluate its components, and determine how to best establish interim priorities;
- The framework of four Goal categories, including the Objectives and Information Needs required to address these Goals. The report also shows a partial list of example data and projects that the group identified while developing the Goals, Objectives, and Information Needs.
- An analysis of the results from the meetings; and,
- Recommendations for the next steps in developing the KASRP.

Figure 1. Kuskokwim Area map showing salmon management districts and escapement monitoring projects. Figure reprinted from Ward et al. 2003.

FEBRUARY 10-12 MEETING

METHODS

Planning Approach

Information needed for sustained salmon populations and their management was identified through a literature search and group nomination process (i.e., a modification of the Nominal Group Technique; Delbecq et al. 1975) from November 2003 through January 2004. The search resulted in a number of items that were then placed within a hierarchy descending from a mission statement to goals, then objectives, and then information needs. Twenty-one KFRC members, advisors, and support staff then met in Bethel from February 10 through February 12 to discuss the hierarchy and prioritize some of its elements. A systems approach, the Analytic Hierarchy Process (AHP; Saaty 1999), was used to structure the hierarchy and evaluate how important its individual elements were to each person and to the group as a whole. The AHP has been used extensively for planning, conflict resolution, and prioritization in such areas as policy development, economics, engineering, medical and military science for decades, and has recently been applied to fisheries research and management (NEFC 1990; Merritt and Criddle 1993, Merritt 2000, 2001, 2002). The AHP uses expert judgment (previous relevant experience supported by rationale thought and knowledge) to structure the hierarchy and assess the interactions of its parts. In the course of this, a complex problem or issue is broken down into levels that permits decision makers to focus on smaller sets of decisions, improving their ability to make accurate judgments. Structuring also allows decision makers to think through a problem in a systematic and thorough manner. The AHP encourages people to explicitly state their judgments of preference or importance. Decision support software, Expert Choice (Forman et al. 1983), was used interactively to structure the problem, depict the influence of weights, and prioritize the elements within the hierarchy.

Structuring and Establishing Priorities

A top-down structuring approach was used, with a mission statement forming the top of the hierarchy. The mission statement was defined as the responsibility the group wanted the KASRP to fulfill. Goals formed the second level of the hierarchy and were defined as long-term achievements that could contribute to accomplishing the mission. Objectives formed the third level of the hierarchy and were defined as measurable statements of purpose. Information Needs formed the fourth level of the hierarchy and were defined as information necessary to achieve the Objective. This fourth level was the lowest level at which the group attempted to all the items that may be needed to achieve the Mission Statement. Below this, the group generated an incomplete list of data types and projects to provide examples of what types of data and actions would be needed to provide the given information (Figure 2; Appendix D).

The KFRC then ranked, or prioritized, elements in Goals 2 through 4. This ranking consisted of assigning numerical weights of importance to different elements of the plan. The ranks were based on expert judgment, and were modified by discussion among members throughout the process. Criteria to assist with the rankings were developed in advance by the group and posted in the front of the room during the discussions. These criteria were:

- Addresses stocks classified as management/yield concerns, and thereafter multiple species.
- Refines management to increase social and economic benefits derived from fisheries.
- Provides insight critical to understanding factors affecting variability in abundance (e.g., long term trends, preseason forecasting).
- Helps to understand important elements of salmon life history in the Kuskokwim Area.
- Contributes to maintaining wild salmon populations or their habitats at levels of productivity that assure sustainability and ecosystem function.

A positive ratio scale with associated verbal equivalents was used to measure importance (Saaty 1999). Numbers between those listed (e.g., 2, or 2.5, etc.) were used to interpolate meanings as a compromise:

Scale of Importance	**Definition**
9	Extreme importance
7	Very strong importance
5	Strong importance
3	Moderate importance
1	Of slight importance

Elements judged to be of equal importance were given equal scores. When ratings differed by more than two points among all participants, it meant there was disagreement, and debate was encouraged. Debates advanced the understanding of important concepts and often clarified the goal, objective or information need. This debate was intended to encourage dialogue and learning while promoting group instead of individual solutions. At the same time, differences of opinion were considered valuable because they highlighted the topics about which there were more and less variety of opinions. Participants were reminded of this before and during the meeting.

Expert Choice was used interactively to depict the influence of weights and derive the priority of information needs. Priorities approximate the strength of importance for each information need adjusted to reflect the importance assigned to the objective addressed by that information need. Mathematically, relative ratings of importance are entered into a vector and normalized. The values from the vector are then multiplied by the weight in the next highest level, and the result is the weight of importance for information needs. The total score for each information need is then calculated by adding the weighted proportions over all objectives within a goal:

$$T_m = \sum_{k=1}^{d} W_k p_{k,m}$$

where

T_m = the total weighted score for information need *m,*
W_k = the weight for objective k,
$p_{k,m}$ = the weighted proportion of the total score for information need m addressing objective k
d = the number of information needs.

Structural Adjust

Structural imbalance in the hierarchy can occur when two categories (such as Objectives) have different numbers of subcategories (such as Information Needs). The weighting given to a category is split among the subcategories under it. Consider the case in which Objectives A and B have equal weights, but Objective A has 4 information needs and Objective B has 2. The information needs under Objective B would score disproportionately high, relative to those under Objective A, because their parent Objective's weighting is split fewer ways, not because they were truly rated any higher. An adjustment feature in Expert Choice can be used to restore priorities to their respective proportion of weight. In the example above, Objective (A) has four information needs and Objective (B) has two, for a total of six information needs in all. To compensate for the imbalance, the structural adjust feature in Expert Choice multiplies A's priority by 4/6 and B's by 2/6. Thus, the overall priorities for A's information needs are not diluted simply because there are many of them. While approximate balance is sought and desired, complex problems do not always lend themselves to balance – thus the advantage of the structural adjust feature.

Structural adjust improves the accuracy of ranking only at the lowest level of the hierarchy (Information Needs, in the case of this workshop). To improve this accuracy, the structural adjustment function must re-weight the higher levels (Objectives, in this case), possibly altering the original ranks assigned by the group. The most accurate ranking by the group are therefore the raw scores (Appendix E1) for the Objectives and the structurally-adjusted scores (Figures 3 - 7) for the Information Needs.

RESULTS AND DISCUSSION

The Framework

Language for a mission statement was proposed and a draft version developed. This version was later revised on March 10, and finalized as:

> "Prepare and implement a long-range comprehensive* research plan for the Kuskokwim Area focused on maintenance of wild salmon populations that provides for the natural range of variability in ecosystem function while striving to meet human needs."

* As defined in the Glossary

where "Long range" refers to a minimum 30-year time horizon. Four goals and their corresponding objectives were discussed, but the development of Goal 1 (relating to using long term ecological research and monitoring to describe ecosystem processes and habitat-related issues) was deferred pending a review of national literature and protocols by a subcommittee (Appendix F). Goal 1 and its hierarchy of Objectives and Information needs will be included in later drafts of this document. The three remaining goals can be categorized as dealing with salmon biology and ecology (Goal 2), fisheries management (Goal 3), and determining the relationships between socioeconomic trends and different fisheries (Goal 4; Table 1).

A total of 54 elements comprise the hierarchy of Goals 2-4 (Appendix D): 3 goals, 12 objectives, and 39 unique information needs. Goal 3 has six objectives, twice the number of objectives as Goals 2 and 4 (see Table 1). It is possible that discussions relating to Goal 3 generated more objectives than the other goals because fisheries management is a broad and varied field, dealing with such topics as escapement goals, run estimation and timing, and the management system itself – including evaluation of actions and regulatory clarity, compliance and enforcement. Additionally, most participants were familiar with or involved in some aspect or consequence of fisheries management, and this familiarity contributed to a comprehensive evaluation of objectives and information needs.

The KFRC recognized that Information Needs required data, which thus formed the next (lower) level of the hierarchy (Data Types, Figure 2). It is possible that some Information Needs identified by the KFRC will also require an assessment or application of policy-related issues in addition to conventional data. An example of such an Information Need could be 3.F.5 (Appendix D), which is the need for information on the effectiveness of inseason actions on accurately guiding harvest to meet the Amount Necessary for Subsistence.

One of the challenges of using the AHP was to determine how to apply a relatively unfamiliar technique (the AHP) to issues about which participants were both informed and opinionated, and from this develop a product that the entire group could support. The group's approach to this challenge was to research past uses of the AHP and interview past participants to help get an "advance mortem" that would help when using the technique for the KASRP. Based on feedback from participants in the Feb 10-12 meeting, the advance steps that appear to have helped include:

- Identifying many of the hierarchy's elements in advance of the meeting;
- Developing the criteria used to evaluate these elements in advance of the meeting;
- Not requiring final ratings to be within a certain spread (e.g., final ratings could differ by more than 2 points);
- Encouraging open discussion by participants that were not the designated "rankers" for their organization;
- Reviewing an example of AHP (choosing a vacation destination) before applying it to Kuskokwim fisheries issues, and;
- Not locking the group into using AHP for the entirety of the plan. Instead, the group took an adaptive approach, using the February 10-12 meeting to tackle one portion of the plan while assessing how and when to use it in the future.

Although all of these steps were helpful, their degree of benefit differed. The hierarchy developed in advance was relied heavily on during the meeting, allowing the group to devote more time to refining the individual components (e.g., structuring, wordsmithing) and less to having to generate them from scratch. It also helped to ensure that critical elements were not identified after the overall topic had been evaluated or, worse, not identified at all. The advance criteria, in contrast, were not relied on as heavily by the group, and individual group members used them to varying degrees and, on at least one occasion, noted that they also considered other criteria. Allowing the ratings to differ by any amount prevented the group from having to barter votes, or to even defend their votes if they didn't want to. At the same time, it still allowed as much discussion as the group saw fit. Participants who were not the designated rankers actively participated in discussions, and this participation was seen as beneficial. Finally, the group took advantage of the opportunity to bring AHP into the planning process adaptively by having extensive discussions about how best to use it, then deciding to customize it to their planning process. Overall, the least significant advance step appeared to be the development of the criteria. In addition, several group members indicated they would have preferred to have spent more time on the introductory example.

It was also clear that the group's understanding of how to implement the AHP increased over the course of the meeting. Although the group's sophistication increased, group members felt that it was not abnormally so, and was not extensive enough to warrant revising the first day's results based on what was learned in the following days. One of the benefits of the decision to not rank among goals may be the elimination of any bias that could have resulted from an increased familiarity with the AHP between Day 1 and Day 3.

Table 1. Goals and objectives for the Kuskokwim Area Salmon Research Plan.

Goals	**Objectives**
1. Describe the ecosystem structure and function needed to maintain evolutionary and ecosystem processes (such as by implementing an LTER).	1a. Describe climate, spatiotemporal climatic conditions, and the effects on the ecosystem. 1b. Describe physical settings of watersheds. 1c. Describe biota and understand relationship between species and their habitat. 1d. Identify and describe biochemical, geochemical, and nutrient cycles within the ecosystem.
2. Determine salmon life history, genetics and productivity in relation to their place in the ecosystem.	2a. Characterize adult salmon* ecology and biology by stock. 2b. Characterize juvenile salmon* ecology and biology. 2c. Characterize biology through population genetics.
3. Manage salmon stocks* for long term sustained yield with emphasis on subsistence priority.	3a. Review escapement goals and methods used to determine those goals. 3b. Determine sustained escapement thresholds*. 3c. Develop preseason forecasting. 3d. Develop methods for determining inseason run estimates and run timing*. 3e. Conduct run reconstructions. 3f. Evaluate the management system.
4. Determine the relationship between socioeconomic and demographic* trends and subsistence, commercial, and sport fisheries.	4a. Determine the relationship between socioeconomic trends and subsistence opportunity and harvest. 4b. Determine the relationship between socioeconomic trends and commercial opportunity and harvest. 4c. Determine the relationship between socioeconomic trends and sport fish opportunity and harvest.

* As defined in the Glossary

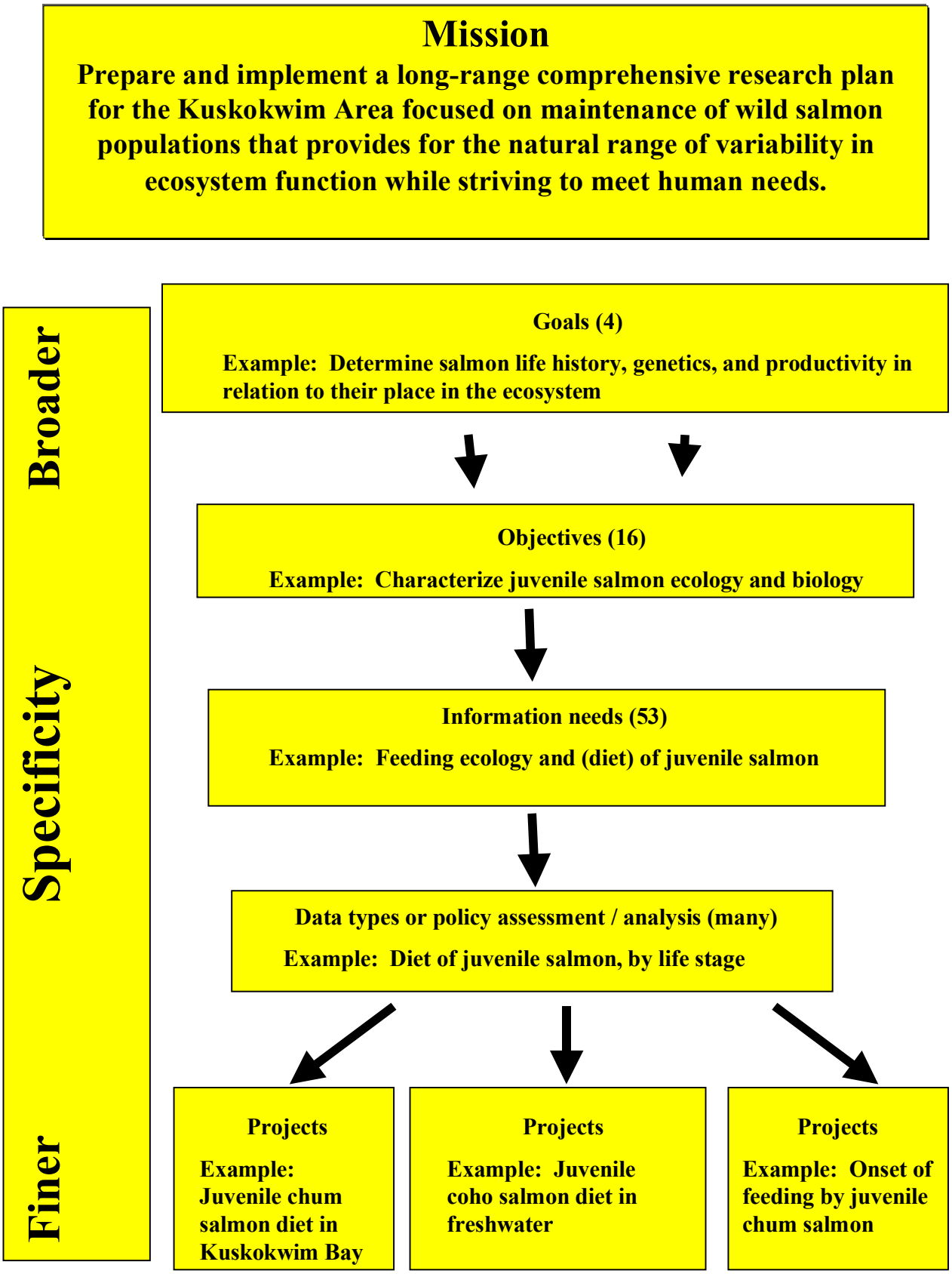

Figure 2. Schematic of hierarchy used by KFRC to structure elements of the research plan. Number in parentheses indicates total number of items in category.

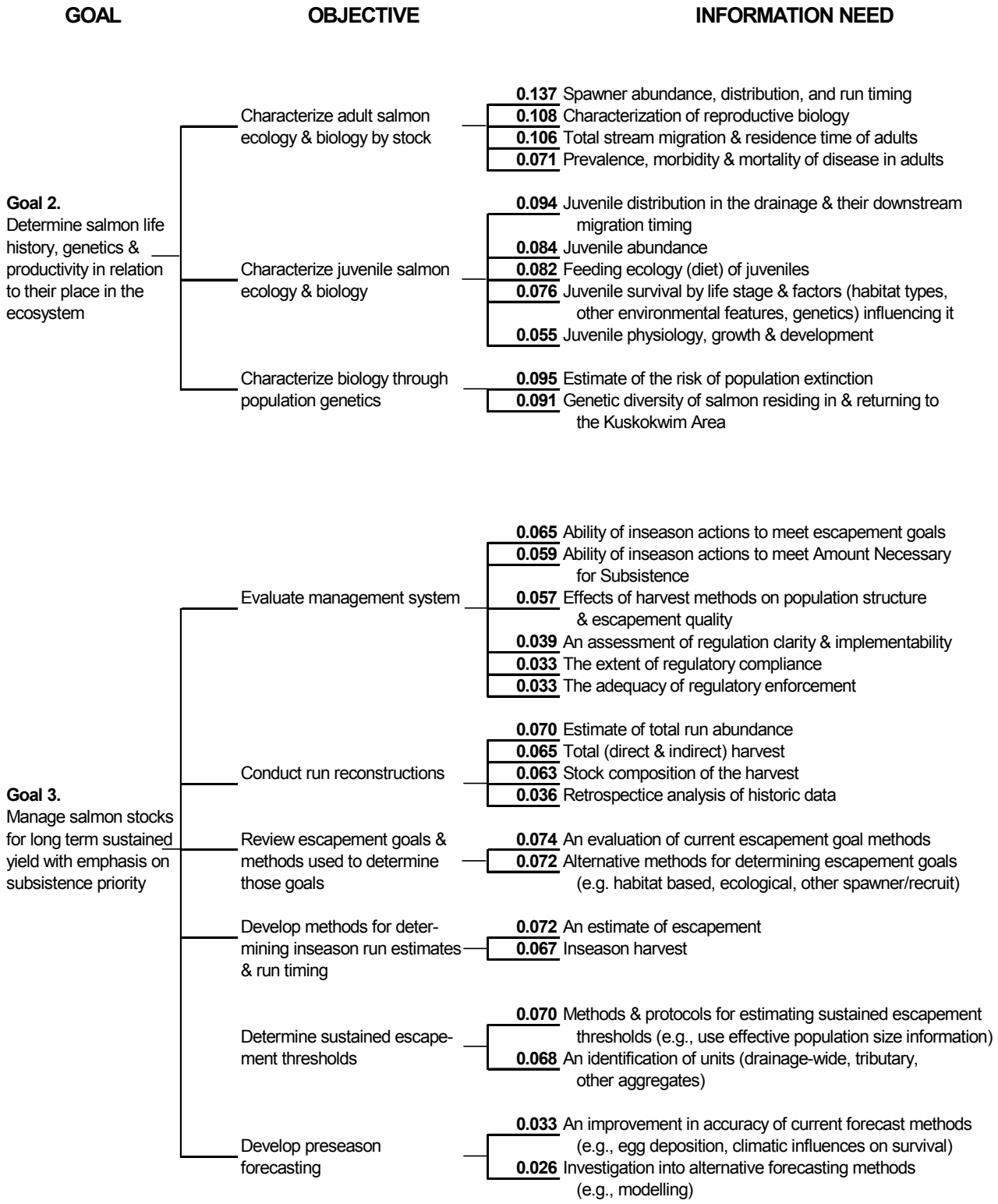

Figure 3. Framework of goals, objectives and information needs, including adjusted weights of importance. Goal 1 framework was not ranked for importance and is thus excluded from this figure.

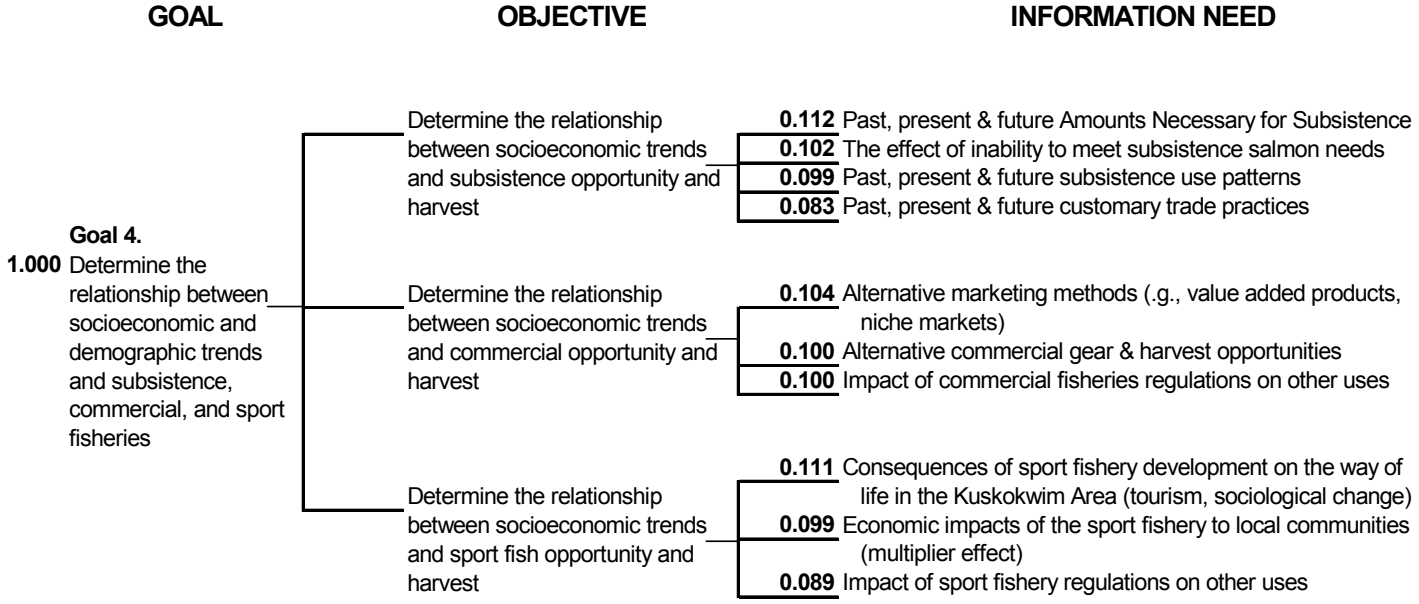

Figure 3. continued.

Priorities

For Goal 2, the highest ranked group of information needs (Figure 5) were:

- spawner abundance, distribution and run timing* in the drainage,
- characterization of reproductive biology, and
- total stream migration and residence time of adults.

The next highest ranked group of information needs have priorities that are virtually identical to each other, and these were:

- an estimate of the risk of population extinction,
- juvenile distribution in the drainage and downstream migration, and
- Genetic diversity* of salmon in the Kuskokwim Area.

The information need regarding juvenile physiology, growth and development was rated the least important of the set.

For Goal 2 the group was in general agreement for the majority of judgments (a spread of 2 to 3.5, on a scale of 1 to 9; see Appendix E). However, there were a few points of disagreement. The greatest differences of opinion concerned the importance of the Objective, "Characterize juvenile salmon ecology and biology" – a spread of 6, reflecting disagreement that the group did not resolve (see Appendix E). While it was agreed there is

a general lack of knowledge regarding the biology and ecology of juvenile salmon in the Kuskokwim Area, the importance of this data gap relative to the importance of addressing the remaining two objectives under Goal 2 was in dispute. Further disagreement (a spread of 4) was observed regarding the importance of the need for information on juvenile abundance.

For Goal 3, the highest ranked groups of information needs had very little discrimination, with the top 12 bunched closely together (Figure 6); the top three were:

- evaluation of current escapement goal methods,
- alternative methods for determining escapement goals, and
- estimate of escapement

Information needs regarding forecasting and regulatory compliance and enforcement were rated the least important of the set.

For Goal 3, the group was in remarkable agreement, considering the large number of judgments required (Appendix E). The greatest differences of opinion concerned forecasting: the importance of "The need to improve the accuracy of current forecast methods" – a spread of 6 –

* As defined in the Glossary

and, “The need to investigate alternative forecasting methods” – a spread of 4.5. The rather low-ranked “Need to assess the clarity of regulations and their implementability” also generated disagreement (a spread of 5).

For Goal 4, there was relatively little discrimination among information needs (Figure 7). The group may believe that any information regarding socioeconomic and demographic trends relating to fisheries is of high importance, but this offers little guidance when attempting to allocate limited funds. The highest ranked group of information needs under Goal 4 concern:

- Past, present and future Amounts Necessary for Subsistence, and
- Consequences of sport fishery development on way of life.

The lowest ranked information need was, “Past, present and future customary trade practices”. Little disagreement was observed among participants in discussions of information needs under Goal 4 (see Appendix E).

The distribution of information needs among objectives was not balanced in Goals 2 and 3, leading to structural imbalance in the framework. In Goal 2, for example, the second objective had five information needs, whereas the third objective had only two information needs. Thus, the structural adjust feature was used to restore priorities in Goals 2 and 3 to their respective proportions; however, Goal 4 was approximately balanced, so was not adjusted (Figures 5 – 7).

Although the group had intended to use the 5 criteria (see Methods) to rank the Objectives and Information Needs, it became clear that different group members relied on these criteria to varying degrees. The criteria set should thus be viewed as a set of guidelines that assisted with the process of separating higher importance needs from those of lesser importance, but that did not comprise the full range of factors used to evaluate and rank elements within the hierarchy.

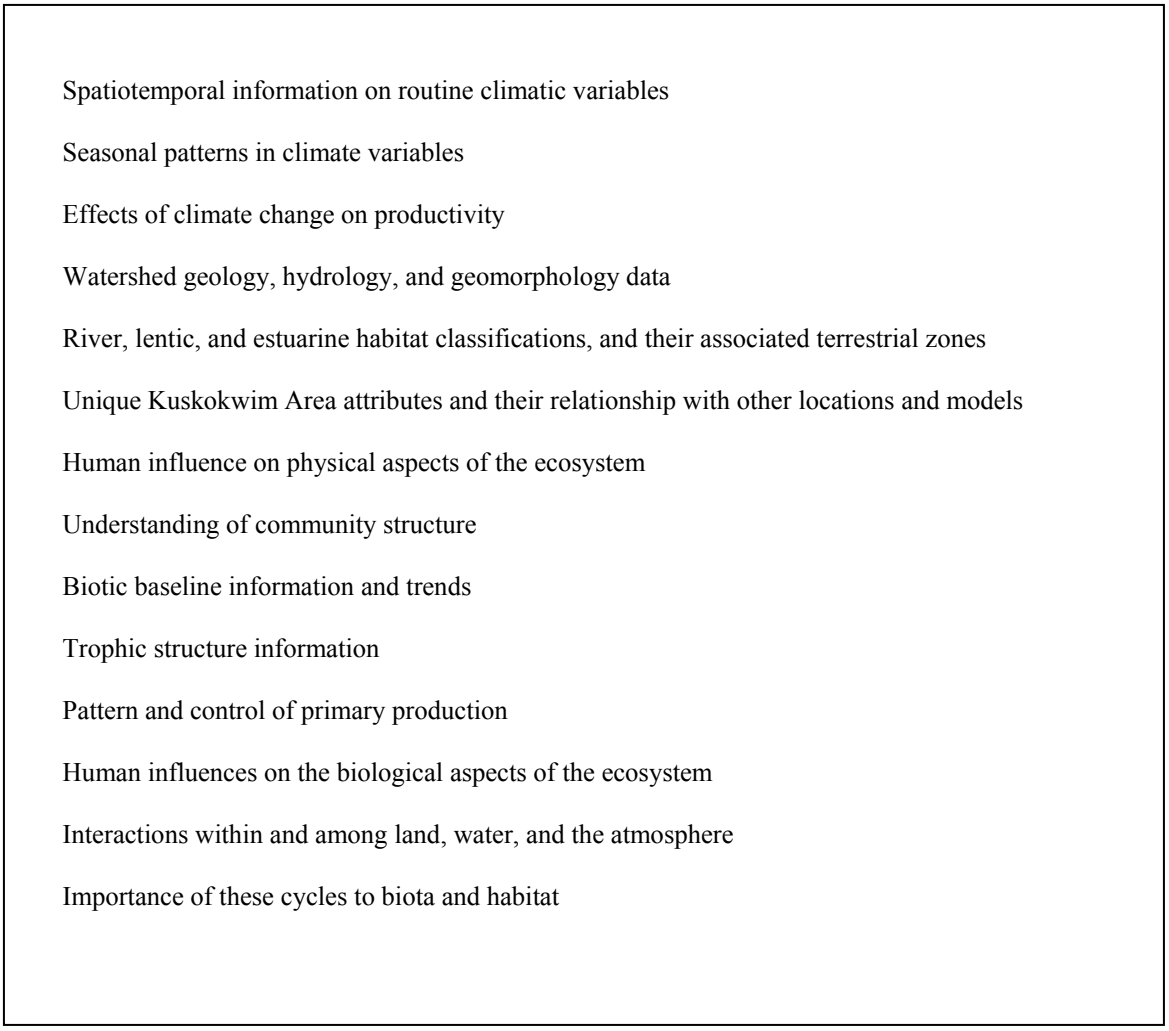

Figure 4. Information needs for Goal 1 (not ranked): Determine the ecosystem structure and function needed to maintain evolutionary and ecosystem processes.

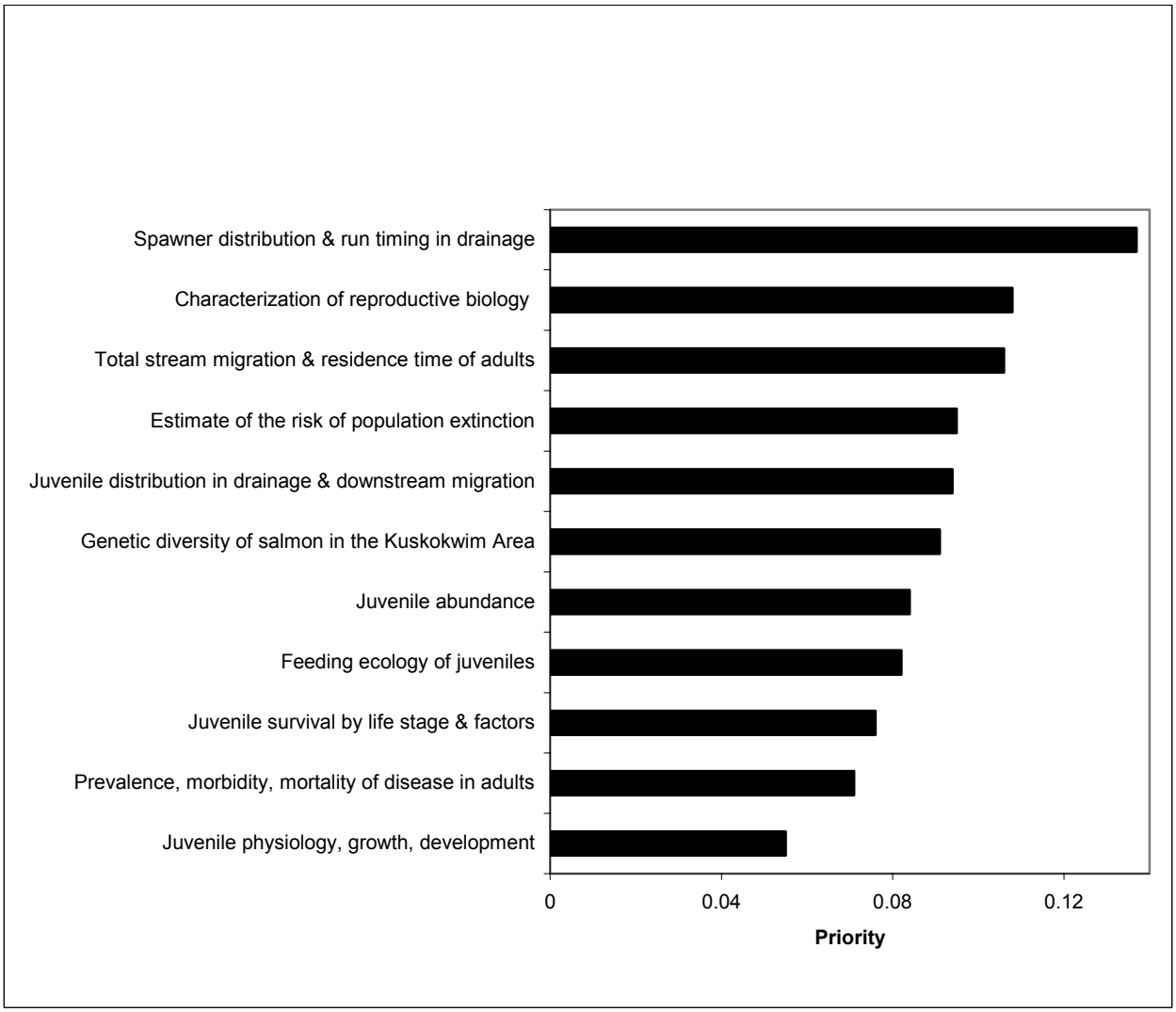

Figure 5. Priority ranking of Information Needs for Goal 2: Determine salmon life history, genetics and productivity in relation to their place in the ecosystem.

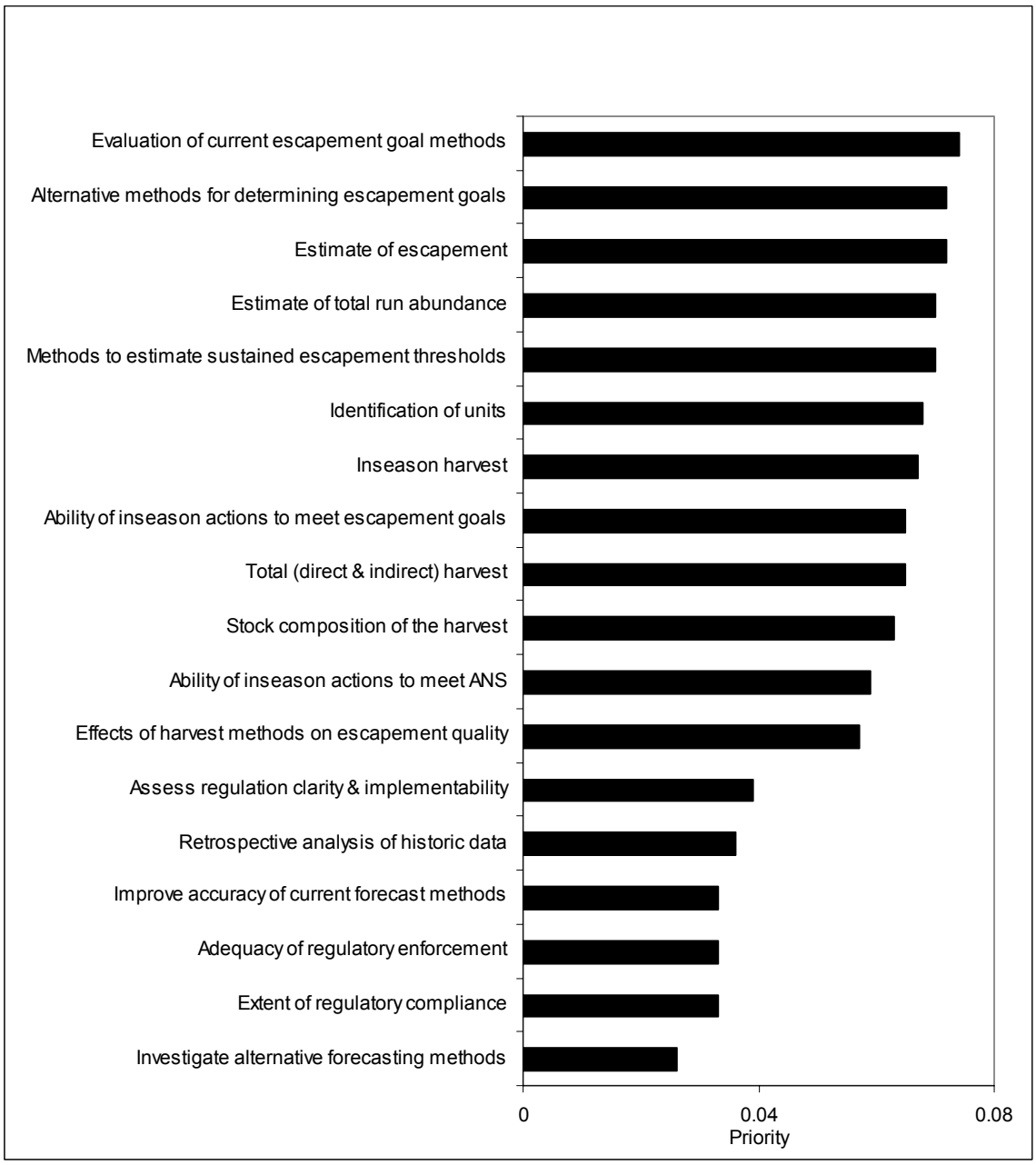

Figure 6. Priority ranking of Information Needs for Goal 3: Manage salmon stocks for long term sustained yield with emphasis on subsistence priority.

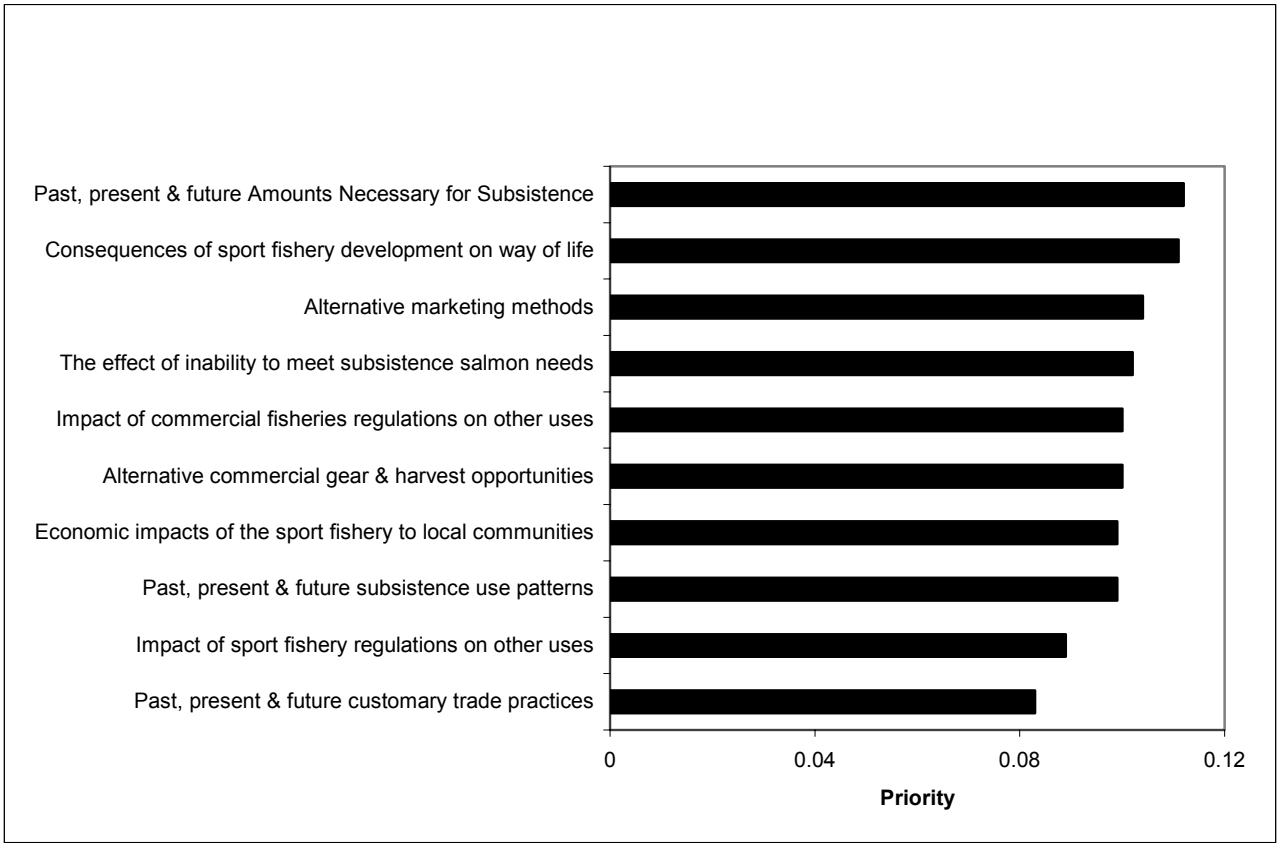

Figure 7. Priority ranking of Information Needs for Goal 4: Determine the relationship between socioeconomic and demographic trends and subsistence, commercial, and sport fisheries.

FEBRUARY 27 SUBGROUP MEETING

METHODS

Planning Approach

The ecosystem subgroup met on February 27 to refine and discuss Goal 1 and to prepare recommendations to the full KFRC. These recommendations were to include how to prioritize items within Goal 1 and how to evaluate Goal 1 with respect to Goals 2 through 4.

The subgroup began by reviewing the Long Term Ecological Research (LTER) program that is funded by the National Science Foundation and currently operating at 21 sites in the U.S. In addition, the concept of a "Biostation" program was introduced by Dr. Zimmerman. The discussion centered on the core research areas of these programs, how they fit with the research objectives in the initial Goal 1 framework, and strategies by which such a program could be developed in the Kuskokwim Area.

The subgroup then reviewed Goal 1 as it was left by the full KFRC meeting from February 10-12. Following the same process used at the February 10-12 meeting, the subgroup revised the language of Goal 1. This language was further refined on March 10, and finalized (Table 1) as:

> "Describe the ecosystem structure and function needed to maintain evolutionary and ecosystem processes (such as by implementing an LTER)."

Structuring and Establishing Priorities

The subgroup then discussed the best way to prioritize objectives and information needs within Goal 1, and the best way to treat Goal 1 relative to Goals 2 through 4. Options included combinations of using AHP to rank elements within Goal 1, using AHP to rank among Goals 1 through 4, not ranking among the goals, and not ranking within Goal 1 and instead using a Biostation to prioritize and develop the elements in a way that emphasizes the functional relation among them. It was noted that the LTER and the biostation programs both have procedures in place to guide how the information is collected and which information is collected first. The procedures help to phase in information at appropriate growth stages of the program, and to make the information that is collected compatible with existing programs. This compatibility makes the information more useful because it can be directly compared to information from other places.

RESULTS AND DISCUSSION

The subgroup developed 4 Objectives needed to support the revised Goal 1, and 14 Information Needs required to pursue the Objectives. At least one example data type was listed for each Information Need (Appendix D). The final version of Goal 1 included all Objectives and Information Needs that were in the version presented at the Feb 10-12 meeting, along with many new ones.

The subgroup recommended NOT ranking the Objectives and Information Needs within Goal 1 for several reasons. First, LTER and Biostation programs have well-developed protocols and methods already in place. Given this, the subgroup felt it would be premature to run AHP on the

framework before knowing how the resulting priorities might complicate the development of the program or reduce some of its value. Second, the subgroup noted the tight linkages among many of the elements, and felt that an assigned rating might send an inappropriate message that some elements should be pursued independently of others, when in reality the elements may need to be considered in groups. Finally, the subgroup felt that meaningful ratings among the elements required expertise that the KFRC did not have, but that Biostation scientists would. Because the group had already recommended pursuing the Goal via a comprehensive biostation, it thus made overall sense to use the Biostation program to develop the Goal's priorities.

The subgroup also recommended NOT ranking Goal 1 against the other Goals for several reasons. First, it was noted that the elements within Goal 1 were substantially different from elements within the other goals, and most comparisons would thus be relatively meaningless. In addition, the subgroup could not identify any funding source that would fund elements under the Goal and any of the Goals, thereby making any rankings between Goal 1 and the others fairly unimportant. Finally, the subgroup felt that the lack of ecosystem-related expertise within the KFRC would make it difficult for the KFRC to meaningfully compare the importance of Goal 1 to the others. Once again, all of these points appeared to argue for the need to develop Goal 1 as a somewhat separate Goal, using a Biostation that would bring in the requisite expertise.

The subgroup agreed that Dr. Zimmerman should make a presentation on LTER and biostation programs at the KFRC meeting on March 9. This presentation would include descriptions of how such programs could be implemented in the Kuskokwim Area, potential sources of support for them, and how they would contribute to the elements within Goal 1. At this full KFRC meeting, the discussion regarding Goal 1 would then be to determine whether any additional elements need to be added to the hierarchy, and then to determine whether to support pursuing the entire hierarchy as a "package" that would be funded by the Biostation program presented by Dr. Zimmerman.

MARCH 9-10 MEETING

METHODS

Planning Approach
Thirteen KFRC members and advisors met on March 9 and 10 in Bethel to review the recommendation of the ecosystem subgroup, compare the four different Goals, and discuss the remainder of the planning process (Appendix G). The draft hierarchy of Goal 1 (as developed by the habitat subgroup on February 27) was circulated in advance. Several habitat biologists and stream ecologists also provided peer comments on the draft hierarchy before the meeting, and these comments were incorporated into the discussion on March 9.

Structuring and Establishing Priorities
Dr. Chris Zimmerman began the discussion of Goal 1 with a presentation of Long-Term Ecological Research programs (LTER) and the concept of Biostation. Biostations are a relatively new initiative that are being attempted on several rivers around the Pacific Rim, and share many core philosophies with the LTER program. Some of the primary goals of a Biostation would be to research ecological processes using a long-term approach that is experimental and adaptive, and to collect data in a way that coordinates with other programs to provide useful comparisons among systems and locations. Such a Biostation could be developed on a river – or series of rivers – in the Kuskokwim Area, and could adaptively address many of the Objectives and Information Needs described in the Goal 1 hierarchy.

Then group than reviewed the Goal 1 hierarchy, refining language and adding elements as with Goals 2, 3, and 4. The group then discussed the recommendations by the habitat subgroup regarding the ranking of items within Goal 1, and the ranking of all goals among one another.

The group then discussed ways in which the KASRP could be of best mutual benefit to the AYK SSI's Research and Restoration plan (R&R). M. Nemeth presented a 2-page proposal of ways in which some elements of the KASRP would developed before the draft NRC report, while other elements would wait until after the NRC report. The final draft of the KASRP would thus be completed after the NRC report but before the final R&R plan.

RESULTS AND DISCUSSION

The Framework
As described earlier, the KFRC revised Goal 1 to read:

> "Describe the ecosystem structure and function needed to maintain evolutionary and ecosystem processes (such as by implementing an LTER)."

The group also revised the overall Mission statement for the last time, as described earlier, to read:

> "Prepare and implement a long-range comprehensive research plan for the Kuskokwim Area focused on maintenance of wild salmon populations that

provides for the natural range of variability in ecosystem function while striving to meet human needs."

The KFRC also supported the concept of pursuing a Biostation in the Kuskokwim Area, to use this Biostation to adaptively pursue many of the Information Needs listed under Goal 1.

Priorities

The KFRC agreed to not rank within Goal 1, for most of the reasons articulated by the subgroup that met on February 27. The KFRC decided not to rank among the Goals, again following the rationale outlined by the subgroup that met on February 27.

The KFRC had considerable discussion about potential interactions between the AYK SSI planning process and the development of the KASRP. The possible choices influenced potential timelines for developing the KASRP, as well as the timing of individual components relative to the different milestones of the AYK SSI planning process. Ultimately, the KFRC identified three milestones for the KASRP (Appendix G). By May 31 2004, the KFRC would complete interim drafts of some KASRP elements (priority research themes and questions, information gap assessment) and more complete drafts of others (salmon life cycle, inventory of existing and past projects). In the fall of 2004, the KFRC would meet again to review the draft NRC report (to be released in the summer of 2004), determine what adjustments to make to the draft KASRP from May 31, and strategize the final draft of the KASRP. This final draft would then be completed by December 31, 2004 so that it could be considered by the AYK SSI as they develop their Research and Restoration plan (due in the spring of 2005). Finally, the KFRC agreed to help develop each of the 4 Goals by assigning a subgroup of KFRC members for each Goal (Appendix G). A projected timeline was developed to show how the AYK SSI, the NRC, and the KASRP processes would interact (Table 2).

Table 2. Timeline showing milestones of AYK SSI, KASRP, and NRC processes.

Revised March 10, 2004

	2004												2005											
Tasks	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
AYK STC meeting	X																					
NRC report 1					?	?																
STC R&R draft												X										
NRC review of STC R&R															X							
AYK SSI symposium																					X	
AYK STC RFP for 2006																						X
NRC active	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
Draft letter to AYK STC	X																					
Life history section			X																			
Report of KFRC information needs			X																			
Project inventory			X																			
Gap assessment - draft			X																			
Research "themes" - draft			X																			
KFRC III meeting							?															
LGL active	X	X	X				X	X	X	X												
Gap assessment - revised										X												
Research "themes" - revised										X												
Planning strategy - includes numerous elements										X												
Public input events: as needed, to be combined with NRC events																						

CONCLUSION

The three meetings held in February and March helped achieve the breadth of input that is considered to be crucial to the success of a long-term plan (as noted by Merritt 2001). Major achievements were:

- Identification and discussion of research needs deemed important, both from the literature and within the Kuskokwim Area
- Knowledge and awareness of concerns of different people, fostered through the discussions and debates among participants,
- Development of a framework consisting of a mission statement, goals, objectives and information needs,
- The development of the timeline and components of interim (May 31, 2004) and final (December 31, 2004) drafts of the research plan.

ACKNOWLEDGEMENTS

Dr. M. Merritt of Research Decision Support (Fairbanks, AK) facilitated the use of the Analytical Hierarchy Process during the workshop from February 10 through February 12. Dr. Merritt, B. Haley, and S. Gilk assisted with software operation and recording throughout the workshop. Dr. Merritt, M. Nemeth, and V. Priebe prepared report drafts. M. Nemeth, B. Haley, the KFRC planning subcommittee (T. Andrew, L. Brannian, K. Gillis, D. Molyneaux, and M. Rearden), and several advisors (R. Cannon, M. Link, J. Spaeder, C. Zimmerman) prepared and/or reviewed advance materials for the meetings and this report. Peer reviewers of the ecosystem Goal and its components include C. Estes (ADF&G), M. Wipfli (University of Alaska – Fairbanks), and M. McLean (ADF&G). D. Hanley assisted with meeting arrangements in Bethel.

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GLOSSARY OF TERMS

Adult salmon – all mature salmon

Biological escapement goal (BEG) – as defined in the State of Alaska's Sustainable Salmon Fisheries Policy, the escapement that provides the greatest potential for maximum sustained yield.

Demographics – The study of populations with reference to size, density, distribution, and parameters such as mortality and reproductive rates.

Genetic diversity - includes genotypic and phenotypic diversity.

Juvenile salmon – salmon in any immature life stage, including early marine life stages in Kuskokwim Bay.

Kuskokwim Area – includes the Kuskokwim River watershed and all other coastal watersheds of the Bering Sea from Cape Newenham north to the Naskonat Peninsula, including the nearshore marine habitat of Kuskokwim Bay.

Migration timing – the total time traveling within the Kuskokwim Area to the spawning grounds.

Non-market – a variety of goods, activities or services that have no market, yet have public value. Nonmarket economics is used to determine the net economic values that people would place on traditionally nonmarket goods, activities and services if markets did exist for these commodities.

Patterns - includes both a time and space component.

Phenotypic - includes behavioral traits.

Run timing – the timing of run, for example early versus late runs.

Salmon stock – a locally interbreeding group of salmon that is distinguished by a distinct combination of genetic, phenotypic, life history, and habitat characteristics, or an aggregation of two or more interbreeding groups which occur within the same geographic area and is managed as a unit (5 AAC 39.222).

Socioeconomics – a field of study that seeks to develop an understanding of human behavior and values in relationship to activities (e.g., fishing) to better guide management decisions. Social concepts measured include preference, attitude, motivation, satisfaction, and participation. Economic concepts measured include net economic values that fishers place on their experience (nonmarket economics), and expenditures (market economics).

Stock of concern - as defined in the State of Alaska's Sustainable Salmon Fisheries Policy, a salmon stock for which there is a yield, management, or conservation concern.

Sustainable escapement goal (SEG) – as defined in the State of Alaska's Sustainable Salmon Fisheries Policy, a level of escapement, indicated by an index or an escapement estimate, that is known to provide for a sustained yield over a 5 to 10 year period.

Sustained escapement threshold (SET) - threshold level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized. In practice, SET can be estimated

based on lower ranges of historical escapements levels, for which the salmon stock has consistently demonstrated the ability to sustain itself; the SET is lower than the lower bound of the BEG and lower than the lower bound of the SEG; the SET is established by the department in consultation with the board, as needed for salmon stocks of management or conservation concern (5 AAC 39.222).

Total residence time – all of the time adult salmon spend in freshwater.

Yield concern – a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields or harvestable surpluses, above a stock's escapement needs.

Appendix A. 5 AAC 07.365. Board of Fisheries sanctioned Kuskokwim River salmon management plan.

(a) The objective of the Kuskokwim River Salmon Management Plan is to provide guidelines for the management of the Kuskokwim River commercial salmon fishery which will result in sustained yields of the salmon stocks large enough to provide for subsistence needs and an economically viable commercial fishery.

(b) It is the intent of the Board of Fisheries that the Kuskokwim River king salmon stock be managed in a conservative manner consistent with sustained yield principles and the subsistence priority and, consistent with this intent, that the available surpluses of other salmon stocks be taken. To accomplish these objectives, the department shall mange the Kuskokwim River commercial salmon fishery as follows:

there may not be a directed commercial king salmon fishery;

repealed (6/14/90);

only those waters of District 1 downstream of ADF&G regulatory markers located at Bethel may be open during the first fishing period;

there must be at least three eight-hour fishing periods in June.

Although no directed fishery on king salmon is allowed, the incidental catch guideline harvest level for king salmon taken during fisheries directed on other species is 15,000 – 50,000 fish;

To the extent possible, the department shall provide at least 24 hours' advance notice of the opening of District 1 and District 2 fishing periods.

District 1 and District 2 fishing periods are from 1:00 p.m. until 7:00 p.m.; when longer periods are allowed, the extra time is to be divided before 1:00 p.m. and after 7:00 p.m.

(c) A person may not sell salmon roe taken to Districts 1 and 2. (Eff. 6/10/87, Register 102; and 4/2/88, Register 105; am 6/14/90, Register 115; am 6/10/98, Register 146)

Authority: AS 16.05.060 AS 16.05.251

Appendix B. Bibliography of references used to identify salmon information needs important to Kuskokwim Area stakeholder groups.

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Appendix C. Members of the KFRC who participated in meetings February 10-12, 2004 to develop a research framework for sustained yield management of salmon in the Kuskokwim Area.

Organization	Name	Primary Representative (for ranking issues)
KFRC member organizations and representatives		
Alaska Department of Fish and Game, Commercial Fisheries (ADF&G CF)	Doug Molyneaux Craig Whitmore	X
Alaska Department of Fish and Game, Sport Fisheries (ADF&G SF)	Charles Swanton Lisa Stuby	X
Alaska Department of Fish and Game, Division of Subsistence (ADF&G DS)	Tracie Krauthoefer	X
Association of Village Council Presidents (AVCP)	Tim Andrew Jennifer Hooper	X
Bering Sea Fishermen's Association (BSFA)	Karen Gillis John White (advisor)	X
Kuskokwim Native Association (KNA)	Dave Cannon Dwayne Hoffman	X
Native Village of Kwinhagak (NVK)	Willard Church	X
US Fish and Wildlife Service, Kenai Fisheries Assistance Office (KFAO)	Ken Harper Tim Roettiger	X

US Fish and Wildlife Service, Togiak National Wildlife (TNWR)	Pat Walsh	X
US Fish and Wildlife Service, Yukon Delta National Wildlife Refuge (YDNWR)	Mike Rearden Jim Finn	X
US Geological Survey (USGS) (consulting)		
Meeting support - organizations and personnel		
Resource Decision Support	Margaret Merritt	Meeting facilitation
LGL Alaska Research Associates, Inc.	Beth Haley Matt Nemeth	Technical support Plan coordinator
ADF&G, Commercial Fisheries	Sara Gilk	Technical support

Appendix D. Kuskokwim Information Needs Hierarchy, as developed by the KFRC in February and March 2004

Key to the hierarchy:

I. GOAL

A. Objective

1. Information Need (blue font)

a) Data Type (green, italicized font)

NOTES:

Within each Goal, prioritization has been done among Objectives and Information Needs

Possible data types (green font) have been added under each information need to provide examples. These examples are not meant to be a complete list, and have not been prioritized.

I. GOAL 1: DETERMINE THE ECOSYSTEM STRUCTURE AND FUNCTION NEEDED TO MAINTAIN EVOLUTIONARY AND ECOSYSTEM PROCESSES (SUCH AS BY IMPLEMENTING AN LTER).

A. Objective: Describe climate, spatiotemporal climatic conditions, and the effects on the ecosystem

1. Information Need: spatiotemporal information on routine climatic variables

    a) *Example data: Baseline data on air temp, precipitation, water temp, river discharge, water turbidity, water conductance, etc (these variables may be relevant throughout other areas of the hierarchy)*

    b) *Example data: Need to know degree and causes of variability in routine physical variables*

2. Information Need: seasonal patterns* in climate variables

    a) *Example data: Ice out and freeze up times*

    b) *Example data: Precipitation patterns*

    c) *Example data: Periodicity of high water events*

3. Information Need: effects of climate change on productivity

    a) *Example data: Extent of glacial recession and the effects on the aquatic ecosystem*

    b) *Example data: Effects of temp on periphyton production*

B. Objective: Describe physical settings of watersheds

1. Information Need: watershed geology, hydrology, and geomorphology data

    a) *Example data: Watershed discharge data*

    b) *Example data: Sediment transport data*

    c) *Example data: Location and extent of hyporheic flow and groundwater discharge/recharge*

    d) *Example data: Channel form and gradient data*

2. Information Need: river, lentic, and estuarine habitat classifications, and their associated terrestrial zones.

    a) *Example data: baseline data on primary channel networks, flood plain habitat, riparia, and estuary habitats*

    b) *Example data: baseline data on flood plain habitat*

    c) *Example data: digital elevation models (DEMS) of aquatic*

* As defined in the Glossary

3. Information Need: unique Kuskokwim Area attributes and their relationship with other locations and models

    a) *Example data: How permafrost alters models of hydrologic process models developed in other places*

4. Information Need: human influence on physical aspects of the ecosystem

    a) *Example data: Location and effects of existing resource extraction*

    b) *Example data: Location and effects of future resource extraction*

    c) *Example data: Need to know effects of fishing on the ecosystem*

C. Objective: Describe biota and understand relationship between species and their habitat

1. Information Need: understanding of community structure

    a) *Example data: Predator/prey relationships*

    b) *Example data: Successional stages of floral communities*

    c) *Example data: Successional stages of fauna*

2. Information Need: biotic baseline information and trends

    a) *Example data: Biomass of various species*

    b) *Example data: Abundance of various species*

    c) *Example data: Species distribution*

3. Information Need: trophic structure information

    a) *Example data: Sources of nutrient and energy inputs*

    b) *Example data: Flow of nutrients and energy through the system*

    c) *Example data: Food web descriptions*

4. Information Need: pattern and control of primary production

    a) *Example data: Effects of ice-out time on phytoplankton abundance*

5. Information Need: human influences on the biological aspects of the ecosystem

    a) *Example data: Consider cumulative effects*

    b) *Example data: Effects of fishing on energy flow and the ecosystem*

    c) *Example data: Distribution patterns of humans*

    d) *Example data: Resiliency of ecosystem to human influences*

(1) Project: Estimate effects of press vs. pulse disturbance on specific parts of the ecosystem

D. Objective: Identify and describe biochemical, geochemical, and nutrient cycles within the ecosystem

1. Information Need: interactions within and among land, water, and the atmosphere

a) Example data: Sources and abundance of nutrient flux

b) Example data: Gas exchange in microbial systems

c) Example data: Heavy metals

d) Example data: Estimate carbon budget

(1) Example project: Annual loss of carbon from system vs. annual input

2. Information Need: importance of these cycles to biota and habitat

a) Example data: Importance of gas flux to primary productivity

b) Example data: The role of nutrient exchange in driving productivity

II. GOAL 2: DETERMINE SALMON LIFE HISTORY, GENETICS, AND PRODUCTIVITY IN RELATION TO THEIR PLACE IN THE ECOSYSTEM.

A. Objective: Characterize adult salmon ecology and biology by stock

1. Information Need: Current abundance, distribution, and run timing of spawning adults in the drainage

a) Example data: Distribution of spawning adults

2. Information Need: Total stream migration and residence time of adults

a) Example data: Length of time spent by adults in freshwater

3. Information Need: Characterization of reproductive biology

a) Example data: Fecundity.

4. Information Need: Prevalence, morbidity, and mortality of disease in adults

a) Example data: Presence and levels of Icthyophonous in populations

B. Objective: Characterize juvenile salmon* ecology and biology

1. Information Need: Distribution of juveniles in the drainage and their downstream migration timing*.

* As defined in the Glossary

a) Example data: Locations of overwintering juvenile coho rearing habitat

2. Information Need: Feeding ecology (diet) of juveniles

a) Example data: Diet of juvenile salmon species, by life stage

3. Information Need: Juvenile survival by life stage and factors (e.g., habitat types, other environmental characteristics, genetics) that influence it.

a) Example data: Overwinter survival of juvenile coho salmon.

4. Information Need: Juvenile salmon* abundance.

a) Example data: Annual estimates of coho salmon smolt production.

5. Information Need: Juvenile physiology, growth, and development

a) Example data: Body condition of juvenile salmon leaving freshwater.

C. Objective: Characterize biology through population genetics

1. Information Need: Genetic diversity* of salmon residing in and returning to the Kuskokwim Area.

a) Example data: Genetic diversity of populations.

2. Information Need: The risk of population extinction.

a) Example data: Estimates of minimum effective population size.

III. GOAL 3: MANAGEMENT OF SALMON STOCKS FOR LONG-TERM SUSTAINED YIELD WITH EMPHASIS ON SUBSISTENCE PRIORITY.

A. Objective: Review escapement goals and methods used to determine those goals.

1. Information Need: Need to evaluate current escapement goal methods.

a) Example data: Relationship between stock and recruitment (brood tables)

2. Information Need: Need to investigate alternative methods for determining escapement goals (e.g., habitat-based, ecological, other spawner-recruit)

a) Example data: Types of alternative methods used elsewhere to estimate salmon escapement

B. Objective: Determine sustained escapement thresholds

1. Information Need: Identify units (drainage-wide, tributary, other aggregates)

* As defined in the Glossary

a) Example data: Data to differentiate among populations or aggregates.

2. Information Need: Need to determine methods and protocols for estimating sustained escapement thresholds (e.g., using effective population size information).

a) Example data: Estimates of effective population sizes.

C. Objective: Develop preseason forecasting.

1. Information Need: Need to investigate alternative forecasting methods (e.g., modeling).

a) Example data: alternative methods used elsewhere to forecast adult returns

2. Information Need: Improved accuracy of current forecast methods (e.g., egg deposition, climatic influences on survivability).

a) Example data: Correlation between run indices and environmental variables.

D. Objective: Develop methods for determining inseason run estimates and run timing.

1. Information Need: Inseason harvest.

a) Example data: Inseason harvest estimates

2. Information Need: Escapement estimates

a) Example data: Escapement by population, species, or location

E. Objective: Conduct run reconstructions.

1. Information Need: Stock composition of harvest

a) Example data: Data that allows differentiation among populations.

2. Information Need: Harvest (e.g., direct and indirect sources of mortality).

a) Example data: Incidental catch in directed fisheries.

3. Information Need: Total escapement.

a) Example data: Degree to which assessment projects (weirs, etc) represent other portions of the drainage.

4. Information Need: Retrospective analysis of historic data.

a) Example data: Identification of which historic catch data are useful indices of run strength.

F. Objective: Evaluate management system.

1. Information Need: Effectiveness of inseason actions in accurately guiding harvest to meet escapement goals.

    a) *Example data: Compliance with inseason actions.*

2. Information Need: Effects of various harvest methods on population structure and escapement quality.

    a) *Example data: Size selectivity of fishing gear.*

3. Information Need: Extent of regulatory compliance.

    a) *Example data: Compliance with sport fish harvest limits.*

4. Information Need: Adequacy of regulatory enforcement.

    a) *Example data: Estimates of which fisheries have undetected regulatory violations.*

5. Information Need: Effectiveness of inseason actions on accurately guiding harvest to meet amount necessary for subsistence.

    a) *Example data: Proportion of households reaching amount necessary for subsistence.*

6. Information Need: Clarity of regulation and their implementability.

    a) *Example data: Degree to which fishers can use regulations to clarify harvest issues.*

IV. GOAL 4: DETERMINE THE RELATIONSHIP BETWEEN SOCIOECONOMIC* AND DEMOGRAPHIC TRENDS* AND SUBSISTENCE, COMMERCIAL, AND SPORT FISHERIES.

A. Objective: Determine the relationship between socioeconomic trends and subsistence opportunity and harvest.

1. Information Need: Past, present, and future customary trade practices.

    a) *Example data: Extent and patterns of customary trade practices.*

2. Information Need: Past, present, and future subsistence use patterns.

    a) *Example data: Effect of loss of commercial fishery on subsistence way of life.*

    a) *Example data: Impact of subsistence salmon harvest regulations on cultural use patterns.*

3. Information Need: Effect of inability to meet subsistence salmon needs.

* As defined in the Glossary

a) Example data: Displacement to other geographic areas, user groups, food resources, or fisheries.

4. Information Need: Past, present, and future Amounts Necessary for Subsistence.

a) Example data: Subsistence catch per unit effort (opportunity), spatial and temporal characteristics of these subsistence harvests, and total subsistence harvests.

b) Example data: Human population trends and their effects on Amounts Necessary for Subsistence.

B. Objective: Determine the relationship between socioeconomic and demographic trends and commercial opportunity and harvest.

1. Information Need: Impact of commercial fishery on other uses.

a) Example data: How commercial openings affect nearby harvests.

2. Information Need: Alternative commercial gear and harvest opportunities.

a) Example data: Identify alternative commercial harvest methods, potential for permit buy-back, potential for permit stacking, potential for co-op harvests.

3. Information Need: Potential for alternative marketing methods

a) Example data: Feasibility of value added products, niche markets, etc.

C. Objective: Determine the relationship between socioeconomic and demographic trends and sport fish opportunity and harvest.

1. Information Need: Impact of sport fish regulations on other uses.

a) Example data: Ability of community-provided services to cope with additional demands from guiding operations (e.g., refuse, health facilities)

b) Example data: Ways in which local involvement in the permitting process can be increased.

2. Information Need: Positive and negatives impacts to local communities (multiplier effect).

a) Example data: Ways to increase value of the sport fishery to the local community.

b) Example data: Estimates of the non-market value of the fishery (e.g., willingness to pay of sport fisheries in the Kuskokwim Area…used to allocate resources between competing users).*

* As defined in the Glossary

3. Information Need: Positive and negative consequences of sport fishery development on the way-of-life in the Kuskokwim Area (tourism, sociological changes).

a) Example data: Identification of existing or potential opportunities to train local residents to enter the sort fishing industry (capacity building/local economic diversification).

Appendix E1. Unadjusted scores for weighing the importance of objectives within their respective nodes, in relation to achieving the goals that they address (organization acronyms described in Appendix C).

Goal / Objective[a]	KFRC Organization										Geo Mean	Spread
	1	2	3	4	5	6	7	8	9	10		
Goal 2 Life history, productivity												
a. Adult ecology, biology by stock	9	8	6.5	7	7	7	7	7	9	7	7.4	2.5
b. Juvenile ecology, biology	6	3	5	5	7	5	5	7	9	5	5.49	6
c. Population genetics, conservation	8	7	8	7	5	7	7	5.75	4	8	6.53	4
Goal 3 Manage for sustained yield												
a. Review escapement goals	7	8	8.5	8	9	8	8	8.5	9	9	8.28	2
b. Determine escapement threshold	5	8	8	8	7	8	9	8.5	9	9	7.85	4
c. Preseason forecasting	4.5	4	4	3	3	2	4	3	5	2	3.31	3
d. Inseason run estimates & timing	9	9	8	7	8	8	7	8.5	6	9	7.89	3
e. Run reconstructions	7	8	5	8	6	6	7	8.5	5	7	6.65	3.5
f. Evaluate management system	4	3	5	7	5	7	6	7	7	5	5.41	4
Goal 4. Socioeconomic relations												
a. Relations with subsistence fishing	8	9	8	9	8	8	9	7	8	9	8.27	2
b. Relations with commercial fishing	7	6	7	8	6	5	7	6	7	5	6.33	3
c. Relations with sport fishing	6	7	5	7	7	7	6	5	6	7	6.25	2

[a] For complete wording of goals and objectives refer to Table 1.

Appendix E2. Unadjusted scores for weighing the importance of information needs within their respective nodes, in relation to achieving the objectives that they address, for Goal 2 (organization acronyms described in Appendix C).

Goal / Objective / Information Need[a]	KFRC organization										Geo Mean	Spread
Goal 2 Life history, productivity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
Objective a. Adult ecology, biology by stock												
Spawner abundance, distribution & run timing in drainage	9	8	7	7	7	8	-	7	8	7	7.53	2
Total stream migration & residence time	6	7	4	5	6	6	-	6	7	6	5.82	3
Characterization of reproductive biology	5	5	8	5	6	7	-	4.5	8	6	5.93	3.5
Prevalence, morbidity, mortality of disease	3	3	5.5	5	4	5	-	4	5	2	3.88	3.5
Objective b. Juvenile ecology, biology												
Juvenile distribution in drainage & downstream migration	6.5	8	6	6	7	9	-	7	7	6	6.88	3
Feeding ecology of juveniles	6	5.5	5	6	5	7	-	7	5	8	5.97	3
Juvenile survival by life stage & factors	4	5	7	5	5	6	-	7	7	5	5.57	3
Juvenile abundance	5	7	6.5	4	6	8	-	7	6	7	6.16	4
Juvenile physiology, growth, development	6	6	4	3	5	3	-	3	5	3	4.05	3
Objective c. Population genetics, conservation												
Genetic diversity of salmon in the Kuskokwim Area	9	7	7	7	7	7	8	8.5	9	9	7.80	2
Estimate the risk of population extinction	7	9	8	8	7	9	9	8	8	9	8.16	2

[a] For complete wording of goals, objectives, and information needs, refer to Appendix D.

Appendix E3. Unadjusted scores for weighing the importance of information needs within their respective nodes, in relation to achieving the objectives that they address, for Goal 3 (organization acronyms described in Appendix C).

Goal / Objective / Information Need[a]	KFRC Organization										Geo Mean	Spread
Goal 3 Salmon management	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
Objective a. Review escapement goals												
Evaluation of current escapement goal methods	8	8	8	7	8	8	7	7.5	8	9	7.83	2
Alternative methods for determining escapement goals	6	7	8	8	8	8	7	7	9	9	7.65	3
b. Determine escapement threshold												
Identification of units	7	8	7	8	6	8	8	8	7	9	7.56	3
Methods for estimating sustained escapement thresholds	8	8	8	7	8	7	8	7	9	9	7.87	2
c. Preseason forecasting												
Investigation into alternative forecasting methods	4	6	6.5	3	6	3	3	6	-	2	4.07	4.5
Improvement in accuracy of current forecast methods	5	8	8	4	6	7	3	8	-	2	5.16	6
d. Inseason run estimates & timing												
Inseason harvest	7	8	7.5	7	8	9	8	8	7	9	7.82	2
Estimate of escapement	9	8	8.5	8	8	9	8	7	9	9	8.33	2
e. Run reconstructions												
Stock composition of the harvest	8	8	7	7	8	7	7	7.5	7	7	7.34	1
Total (direct & indirect) harvest	6	7	8	8	8	8	8	8	7	7	7.47	2
Estimate of total run abundance	8	9	7	8	8	8	8	7	9	9	8.07	2
Retrospective analysis of historic data	3	6	5	4	3	3	4	5	6	4	4.16	3

Goal / Objective / Information Need[a]	KFRC Organization										Geo Mean	Spread
Goal 3 Salmon management	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
f. Evaluate management system												
Ability of inseason actions to meet escapement goals	9	9	8	8	7	8	8.5	8	7	9	8.12	2
Effects of harvest methods on escapement quality	7	8	7	6	6	8	7	7.5	7	8	7.11	2
The extent of regulatory compliance	3	4	4	4	4	3	5	4	6	5	4.11	3
The adequacy of regulatory enforcement	3	4	5	4	4	3	4	4	6	5	4.11	3
Ability of inseason actions to meet ANS	6	8	7	8	7	7	8	7	7	9	7.36	3
Assessment of regulation clarity & implementability	5	6	5	6	6	4	6	4.5	2	7	4.91	5

[a] For complete wording of goals, objectives, and information needs, refer to Appendix D.

Appendix E4. Unadjusted scores for weighing the importance of information needs within their respective nodes, in relation to achieving the objectives that they address, for Goal 4 (organization acronyms described in Appendix C).

Goal / Objective / Information Need[a]	KFRC Organization										Geo Mean	Spread
Goal 4. Socioeconomic and demographic information	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
a. Relations with subsistence fishing												
Past, present & future customary trade practices	6	6	6	6	7	8	6	6	6	6	6.27	2
Past, present & future subsistence use patterns	8	7	9	7	6	8	9	7	7	7	7.44	3
The effect of inability to meet subsistence salmon needs	7	9	7.5	8	6	9	8	8	8	7	7.70	3
Past, present & future Amounts Necessary for Subsistence	9	8	9	8	8	8	9	8	8	9	8.39	1
b. Relations with commercial fishing												
Impact of commercial fisheries regulations on other uses	4	6	5	4	7	4.5	7	5	7	7	5.51	3
Alternative commercial gear & harvest opportunities	6	4	7	7	5	4.5	7	5	5	6	5.55	3
Alternative marketing methods	7	4	7	8	5	4.5	6	6	5	6	5.73	4
c. Relations with sport fishing												
Impact of sport fishery regulations on other uses	6	6	7	7	6	6	7	7	7	7	6.58	1
Economic impacts of the sport fishery to local communities	5	8	8	8	7	8	8	8	6	8	7.32	3
Consequences of sport fishery development on way of life	8	8	9	9	8	7.5	9	7.5	7	9	8.17	2

[a] For complete wording of goals, objectives, and information needs, refer to Appendix D.

Appendix F. Membership of KFRC ecosystem subgroup that met in Bethel on February 27, 2004, and attendance at the KFRC meeting held March 9 & 10, 2004 in Bethel to discuss the ecosystem goal (Goal 1) and the planning process.

Meeting	Name	Organization
Feb 27, 2004	Christian Zimmerman	US Geological Survey
	Dave Cannon	Kuskokwim Native Association
	Mike Rearden	US Fish and Wildlife Service, Yukon Delta National Wildlife Refuge
	John White	Bering Sea Fishermen's Association
	Matt Nemeth	LGL Alaska Research Associates, Inc.
March 9 & 10, 2004		
	Doug Molyneaux (Chair)	ADF&G/Commercial Fisheries
	Craig Whitmore (partial attendance)	ADF&G/Commercial Fisheries
	Tracie Krauthoefer	ADF&G/Subsistence
	Lisa Stuby	ADF&G/Sport Fish
	Karen Gillis	BSFA
	John White	BSFA
	Dave Cannon	KNA
	Ken Harper	USFWS/KFWRO
	Rich Cannon	USFWS/OSM
	Pat Walsh	USFWS/TNWR
	Mike Rearden	USFWS/YDNWR
	Chris Zimmerman	USGS/AYK SSI
	Matt Nemeth	LGL Alaska Research Associate

Appendix G. Kuskokwim Area Salmon Research Plan: Outline of scope and timeline, March 10, 2004 revision

Original charge:

Planning process will identify major research themes, significant knowledge gaps and research questions, and establish priorities

Also, must consider needs at population/ecosystem levels, and consider salmon in the context of the freshwater/nearshore marine stages of their life cycle.

Products:

- Compilation and synthesis of available information for relevant life stages.
- Draft gap assessment and research framework.
- Draft research needs assessment.
- Detailed salmon research plan.

Overall approach in 2004:

- Develop drafts of those aspects of the KASRP that must be in place regardless of the NRC findings (interim KFRC info priorities, salmon life cycle, project inventory) by May 31, 2004.
- Develop interim drafts of those aspects of the KASRP that are likely to be more heavily influenced by the NRC findings (Gap assessment, research themes, and interim priority types of projects) by May 31.
- Revise existing elements and add in final ones (sources of funding, priority information needs, and how to prioritize projects) by December 2004.

By May 31, 2004:

- Complete review of information needs identified by the planning process thus far, with discussion of priorities identified as of March 10.
- Complete discussion of life cycle, including known information and priority (unknown) information needs (identified above) inserted into relevant sections
- Draft gap assessment: Inventory of past and current Kuskokwim projects, with an identification of which information needs have been addressed partially vs. not at all

- Assessment by major discipline - how well have/are these projects meeting elements of 6 areas: habitat, genetics, social science, stock assessment, biology & ecology, and harvest management?

From all of these, identify and briefly discuss 5 to 10 draft research themes or questions. Examples:

- 1a) Baseline information on climate and physical settings of watersheds
- 1b) Baseline information on biotic communities and productivity
- 2a) Spawner abundance, run timing and distribution in drainage
- 2b) Identification of biological aspects likely to have the greatest effect on salmon productivity (overwinter survival, etc)
- 3a) Evaluation of current escapement goal methods and identification of alternative methods for estimating escapement
- 3b) Estimates of escapement and abundance
- 4a) Future subsistence needs
- 4b) Effects of sport and commercial fisheries on subsistence fisheries and the subsistence way of life

After the NRC report comes out in summer of 2004:

- Revise/complete the gap assessment by discussing how well existing/past projects meet new areas prioritized by the NRC
- Revise/complete key research themes/questions based on NRC report
- Based on the gap assessment and the key research themes, identify priority TYPES of projects:
    - What type of information is needed?
    - For which species?
    - Where (geographically) should this information be obtained?
- Describe ways in which this information should be pursued:
    - Sources of funding
    - Interim priorities at the 1 and 5 year timelines (for example)
    - Priorities under different funding levels
    - Methods and criteria for evaluating project proposals

Complete by December 2004, so that STC can incorporate this into draft R&R plan.

KFRC help:

Subcommittees formed for each of the 4 main goals. These subcommittees will help the planner to access information (i.e., from within their agencies or organizations) and will help provide brainpower to the process. This will also help keep KFRC member organizations and representatives interested and active, while relieving the planning subcommittee of some of the burdens.

- Goal 1 - Ecosystem - White, Rearden, D. Cannon, Walsh
- Goal 2 - Ecology, biology, life history - Harper, Molyneaux, Stuby
- Goal 3 - Harvest management - Whitmore, R. Cannon, Stuby, Molyneaux (T. Andrew?, Church?)
- Goal 4 - Social science / socioeconomic - T. Andrew, Krauthoefer, Church, Whitmore

The planner will continue to interact directly with the planning subcommittee.

Next KFRC meeting:

After the NRC report has come out. Possible time requirement:

- Day 1 - review elements of the KASRP
- Day 2 - review and discuss the NRC report
- Day 3 - identify specific areas of the KASRP plan to revise, based on NRC report.