MATANUSKA-SUSITNA SALMON RESEARCH, MONITORING & EVALUATION PLAN FOR UPPER COOK INLET

PUBLIC REVIEW DRAFT

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I. THE PROJECT

Background

This project is being conducted on behalf and under the direction of the Matanuska-Susitna Borough (Mat-Su Borough) Fish and Wildlife Commission (Commission). The Commission, formerly the Mayor's Blue Ribbon Sportsmen's Committee, was formed in February 2007 to represent the interests of the Mat-Su Borough in the conservation and allocation of fish and wildlife. The Commission advises the Mat-Su Borough Assembly and the State of Alaska Boards of Fish and Game regarding fish and game practices and policies that affect the Mat-Su Borough. The Commission consists of seven representatives from the following segments of the community: one representative from the Mat-Su Borough; one sportfishing representative; one hunting representative; and, four at-large positions.

Sustainability and management of the Mat-Su Borough's tremendous salmon resources is a primary focus of the Commission's efforts. Recent problems have highlighted significant research needs. Poor or declining runs of Chinook, coho and sockeye have occurred in recent years. Restrictions and closures of local sport fisheries have been widespread. Established spawning escapement goals are often not being met. The Board of Fisheries has formally designated a number of salmon Stocks of Concern. The status and causes of Mat-Su Borough salmon problems have been a particularly controversial issue in the management of Upper Cook Inlet (UCI) commercial fisheries which harvest northern-bound salmon stocks along with fish bound for the Kenai Peninsula. In many cases, the available information on stock status and limiting factors has not been sufficient to serve salmon sustainability and management demands.

Through dedicated efforts, the Mat-Su Borough has received an appropriation of State Capital Funds for local fisheries and fish protection (Table 1).Funding was identified for passage improvements, critical habitat acquisition, and a sportfishing economic assessment and salmon research. Additional funds have been provided by the legislature in the Alaska Department of Fish and Game (ADFG) budget for salmon research, restoration and enhancement in the Susitna River drainage and UCI. Mat-Su Borough salmon are also the focus of a number of new initiatives and resources including a Mat-Su Basin Salmon Habitat Partnership involving the Mat-Su Borough, U.S. Fish and Wildlife Service and a coalition of other collaborators; a statewide Chinook Salmon Research Plan being implemented by ADFG; and, a large-scale salmon, habitat, and ecosystem assessment effort for Susitna-Watana Hydropower evaluations, which is overseen by the Alaska Energy Authority. These efforts are in addition to base ADFG assessment and management programs and projects.

Collectively, these appropriations, projects and programs provide a convergence of opportunity and critical mass to further substantive progress in assessment, improvement, and management of Mat-Su Borough salmon resources. The Commission has identified the need to prepare a comprehensive salmon research, monitoring and evaluation(RM&E) Plan to guide application of their dedicated funds in a complementary and effective manner. The planning process is also

expected to inform related efforts by other parties and foster working partnerships and program effectiveness by involving key stakeholders. While the primary funding source for the RM&E Plan is a capital grant from the State of Alaska to the Mat-Su Borough, the RM&E Plan will be constructed so that issues and options identified by stakeholders can be addressed by multiple funding sources. This document details the approach, scope and results of this planning effort.

Table 1. Partial summary of salmon-related research resources in Upper Cook Inlet.

Allocation	Purpose	Amount	Schedule
Mat-Su Borough	FY2014 State Capital Fund allocation for local fisheries and fish protection (passage, acquisition, research) [a] • Culvert replacement ($900,000) • Data gap analysis ($200,000)	$2.5 m	New
ADFG	FY2014 State Capital Fund allocation for Susitna salmon research, restoration & enhancement[a] • Susitna Chinook smolt production ($360,000) • UCI sockeye retrospective scale analysis ($500,000) • Habitat assessment & inventory ($0) • Survey &prioritize wetlands ($100,000) • Fish prioritization Optimization Model ($25,000) • Railroad Culvert Inventory ($20,000) • Beaver dam passage assessment ($75,000)	$2.5 m	New
ADFG	FY2014 State Capital Fund allocation for UCI Chinook salmon enhancement	$2.0 m	New
ADFG	Fishery Management Program		Ongoing
ADFG	Governor's Chinook Initiative	$2.5 m	2012-present
Alaska Energy Authority	Susitna-Watana Project	$50 m	2012-present
USFWS	Matanuska-Susitna Salmon Habitat Partnership		2005-present
TBD	Federal Cook Inlet Disaster Funds	~$0.7 m	Pending

[a] *Bullets denote projects identified through 2014.*

Project Mission

Develop a strategic plan that encompasses the interests of partners and governing agencies in guiding funds towards research, monitoring and evaluation projects selected to manage, protect and improve Mat-Su Borough salmon stocks for optimum benefits while maintaining biological productivity and diversity.

Problems to be addressed

Insufficient, incomplete and uncertain information on stock status, fisheries and the ecosystem impede conservation and management of Mat-Su Borough salmon for optimum sustained benefits. Primary issues contributing to the overall problem include, but are not limited to:

- Recent returns of Chinook, coho and sockeye salmon have been inconsistent and many have declined.
- Spawning escapement goals have been established for only a few salmon stocks and established goals are not regularly met.
- The Board of Fisheries has formally designated a number of salmon returning to Matanuska-Susitna waters as Stocks of Concern.
- Poor salmon returns to Matanuska-Susitna waters limit important sport and personal use fisheries in rivers and streams of the Matanuska-Susitna Borough.
- Poor salmon returns to Matanuska-Susitna waters also constrain UCI commercial fisheries which can intercept significant numbers of these salmon.
- Development and activities by people throughout the Mat-Su Borough will continue to affect salmon habitat, ecology, productivity and fisheries.
- The relative significance of many limiting factors is uncertain.
- While substantial research, monitoring, and evaluation efforts for Mat-Su salmon have been undertaken, a comprehensive RM&E plan does not exist.

Time Horizon

Issues raised and proposed options will be considered relevant within a five year time horizon. Five years is the period of the capital appropriation to the Mat-Su research effort (as well as one life cycle of salmon).

Species Addressed

This Plan is concerned with all five salmon species (Chinook, coho, sockeye, chum and pink).Of these, Chinook and coho salmon are of particular concern due to their sport fishery significance. These differences in importance between species or units are reflected in the prioritization phase of planning. Ecosystem benefits of the RM&E Plan can also be expected to benefit other fish species even though they are not a direct focus of the Plan.

Geographical Area

The RM&E Plan addresses all freshwater watersheds inhabited by salmon originating within the Mat-Su Borough, extending through estuaries into marine waters up to the ordinary high water mark, including the Northern and Central Districts of UCI, to Anchor Point. Significant watersheds include the Susitna and Knik arm systems. The focal area includes the marine waters of UCI because of the potential significance of this area to early survival and productivity of salmon and because significant numbers of northern Cook Inlet salmon are harvested in UCI commercial fisheries.

The Plan does not include marine waters south of Anchor Point, Kenai Peninsula systems, or the municipality of Anchorage:

- Marine waters south of Anchor Point were excluded because a) funds are intended to benefit salmon originating in the Mat-Su Borough and those stocks become increasingly diluted south of Anchor Point; b) RM&E Plan stakeholders have a limited capacity to conduct offshore marine research on salmon; and, c) other plans and funding sources are directed towards research of salmon in offshore marine waters.
- Freshwater streams in the Kenai Peninsula Borough were excluded because salmon originating in the Kenai Peninsula watershed are subject to a different suite of issues and addressed by other entities and processes.
- Freshwater streams within the municipality of Anchorage were excluded at this time although it is acknowledged that Anchorage shares many problems relating to salmon with the Mat-Su Borough. We are not aware of an entity, comparable to the Mat-Su Borough's Commission, with which a partnership can be established. Issues associated with the highly urbanized watersheds of Anchorage would likely also create a differing set of options from those needed to address specific Mat-Su Borough concerns.
- Freshwater streams on the west side of Cook Inlet for excluded for similar reasons.

However, the planning team recognizes the value of keeping interested parties within the Kenai Peninsula Borough and the municipality of Anchorage informed on the progress of the RM&E Plan in order to leverage any opportunities for shared benefits of the process and plan.

Figure 1. Matanuska-Susitna Borough (yellow outline) and Upper Cook Inlet marine waters north of Anchor Point addressed by this RM&E Plan.

Related Policies and Plans

The RM&E Plan was developed within the context of policies, plans and values related to salmon protection and management as identified by the Mat-Su Borough and other entities. Examples include:

- Alaska policies for sustainable salmon fishery management and escapement goals
- Mat-Su Borough Comprehensive Plan
- Strategic Action Plan of the Mat-Su Basin Salmon Habitat Partnership
- Matanuska River Management Plan
- Mat-Su Stormwater Management Plan
- Mat-Su Wetlands Management Plan
- ADFG Statewide Chinook Salmon Research Plan
- Fishery Management Plans adopted by the Board of Fisheries
- Alaska Sustainable Salmon Fund
- Alaska Energy Authority is funding Susitna-Watana hydropower evaluations

Application of the Plan

The primary application of this strategic plan is for guidance of funding decisions for research, monitoring and evaluation. This plan identifies information needed to help to ensure that research, monitoring and evaluation remains focused on the highest priorities during the 3-5 year plan horizon (from 2015 up to 2020). Thereafter, updates to the plan may be needed to address changes in the original problem, or to incorporate new information and improved technologies. Any updates will also consider the effectiveness of the plan and its implementation.

Information developed according to guidance in this plan is also expected to inform policies, regulations and best management practices (BMPs) for management of salmon fisheries, as well as salmon habitat use, conservation and restoration, in the Mat-Su Borough. Implementation will be facilitated by identifying the appropriate governing, monitoring and/or enforcement entities for each such option recommended through the planning process, i.e., conservation easements, setbacks, buffers, and water quality regulations. Identifying appropriate funding mechanisms will also facilitate implementation of these recommendations.

Finally, this plan will increase knowledge and awareness of research and management concerns, and provide a greater understanding of the potential coordination of expertise and funds among stakeholders interested in salmon originating in the waters of the Mat-Su Borough, and their fisheries in UCI.

II. THE PLANNING PROCESS

Planning Groups & Roles

Core Planning Team included the Mat-Su Borough Environmental Planner (Frankie Barker), a Commission representative (Larry Engel), and lead consultants (Ray Beamesderfer of R2 and Peggy Merritt of Resource Decision Support). This team facilitated the planning process on behalf of the Commission by drafting a plan scope and plan components for review by the Commission. The Core Planning Team also organized and facilitated involvement by other parties to this planning process and captured corresponding work products in the completion of a RM&E Plan. Jim Hasbrouck of ADF&G provided assistance to the Core Planning Team in consideration of planning goals and objectives.

Mat-Su Borough Fish and Wildlife Commission consists of seven members. The Commission established the plan's scope, goals and objectives. The Commission and Mat-Su Borough will solicit proposals and identify specific projects for implementation based on guidance in the RM&E Plan. The Commission will identify projects with specific application to key problems – this is not a basic research program. The Mat-Su Borough will ultimately ensure that resources are used consistent with their needs and obligations.

Stakeholder Group included invitees from state and federal agencies, fishery organizations and other stakeholders as identified by the Commission. These stakeholders attended a planning workshop to identify and prioritize issues and options to address goals and objectives identified by the Commission.

Public. Consistent with long-standing Mat-Su Borough policies, Commission meetings, including a planning workshop, were open to the public. The public is also being provided with opportunity to review and comment on this draft plan.

Consultants. Project coordination and implementation is being facilitated on behalf of the Commission by Ray Beamesderfer and Kai Steimle of R2 Resource Consultants and Peggy Merritt of Resource Decision Support. These consultants assist with guiding the process and drafting the plan. Additional technical assistance was provided at the planning workshop by Mac Minard of Northwestern Natural Resource Consultants.

Work Plan

1. **Define plan scope and process (described in this document).**

   This work was completed by the Core Planning Team. Proposals will be reviewed and revised by the Commission before further implementation.

2. **Clarify the mission, and identify and prioritize plan goals and objectives.**

   The Commission identified upper level elements of the RM&E Plan from examples prepared by the Core Planning Team. The Core Planning Team also developed criteria for judging importance and prioritize goals and objectives. Through the planning process with the Stakeholder Group, scrutiny of words, clarification of concepts and introductions of additional knowledge led to changes in the initial goal and objective statements to more accurately reflect an assessment of the problem.

3. **Complete an information review and inventory to identify information gaps relative to goals and objectives identified by the Commission.**

   An information gap analysis helped identify critical needs for knowledge to ensure that the best possible projects are solicited and funded with existing resources. The most efficient and effective use of funds will be to complement other efforts and initiatives, capitalize on shared opportunities, and avoid duplication of effort. The state of available knowledge for each goal/objective in Task 2 was identified and documented to inform subsequent efforts to identify and prioritize issues and options. This inventory characterized information availability for each goal and objective in one of three states: 1) that knowledge is adequate for management, 2) partially known, or 3) inadequate. Availability of knowledge was included in the suite of criteria used for identifying and prioritizing issues and options.

4. **Identify and prioritize issues and options in a facilitated strategic planning workshop of the Stakeholder Group.**

   A robust RM&E Plan will objectively address concerns by a broad spectrum of interests. Involving key stakeholders in plan development will ensure a strong foundation for a comprehensive and effective planning effort. Differences in priorities among salmon species are captured at the issues level. Results of the information review and inventory were presented to facilitate identification and prioritization of plan elements.

5. **Complete Research, Monitoring and Evaluation plan.**

   The RM&E Plan documents results of all previous tasks including: a) planning scope and methodology, b) research goals and objectives, c) information summary and review, and d) issues and options. The plan will also highlight data gaps based on a comparison of the available information with needs and options identified at the strategic planning workshop. This activity was completed by the Core Planning Team consistent with workshop discussions and results.

6. **Conduct public review process of the draft Plan.**

   Interested public can attend and observe the workshop process. Per standard Mat-Su Borough protocols, the public will be provided a time period to review and comment on the written draft plan. Comments received after the review period will be addressed in the plan with revisions and explanations as appropriate.

7. **Solicit proposals for research, monitoring and evaluation projects and select for implementation.**

   The Commission will identify project areas for funding with available resources based on guidance in the RM&E Plan. Proposals will be invited for consideration through an open solicitation process. Proposals will be ranked according to criteria including consistency with priorities, qualifications and experience, past performance, project approach, and proposal quality, and costs.

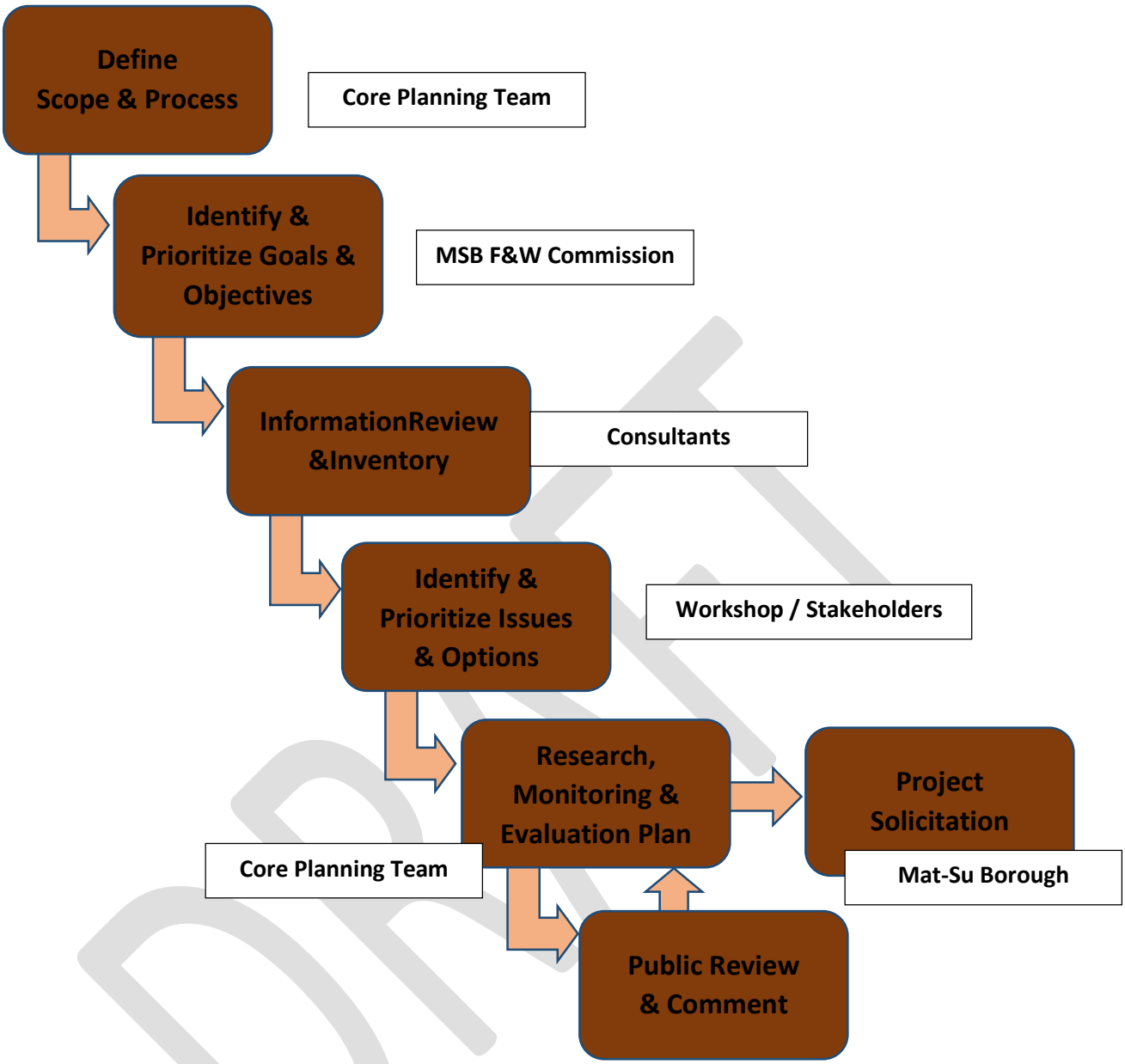

Figure 2. Plan development steps and responsibilities.

Table 2. Project schedule.

Task	2014				2014			
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1. Plan scope & process	■							
2. Identify & prioritize goals & objectives		■	■	■				
3.Information review & inventory			■	■	■			
4.Workshop: issues & options					■			
5.Complete draft plan						■		
6.Public review						■		
7.Project solicitation & selection							■	■

Plan Elements

The RM&E Plan identifies goals, objectives, issues, and options organized in a hierarchical structure (Figure 3).

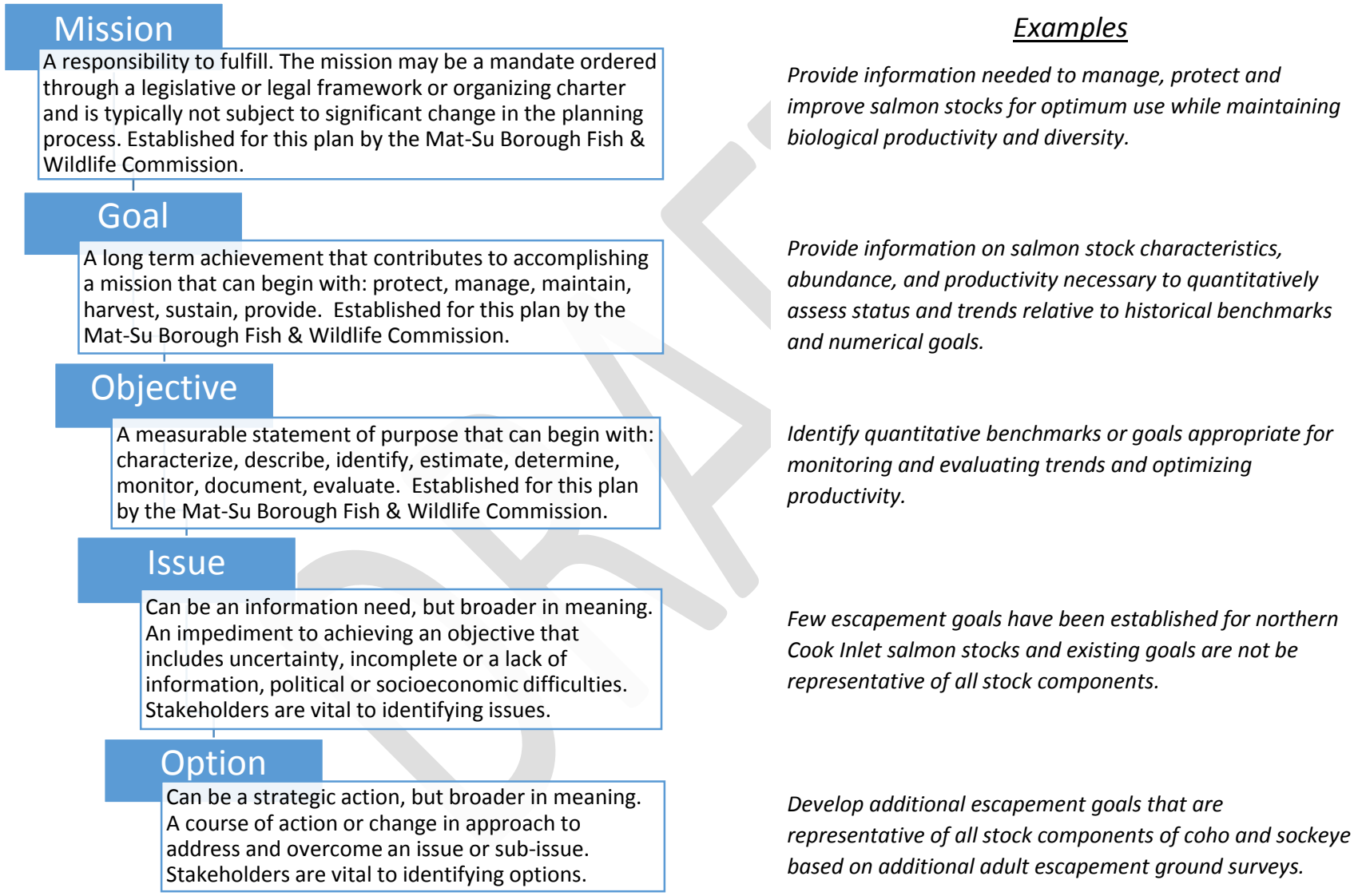

Figure 3. Definitions and examples of RM&E Plan elements.

Establishing Plan Priorities – The Analytic Hierarchy Process

A formal, structured decision process was used to identify and rate specific issues and options related to program goals and objectives. The Analytic Hierarchy Process (AHP) is a systems analysis tool designed to structure and address complex problems through expert judgment (Saaty 1999).Expert judgment is defined as "previous relevant experience, supported by rational thought and knowledge" (Saaty 1999). The process defines and communicates the problem, encourages explicit statements of importance or preference, incorporates diverse viewpoints, and increases the likelihood of finding an optimal solution.

This process was developed in the 1970s and has since found wide application to address planning, conflict resolution, and prioritization in such areas as policy development, economics, engineering, medicine and military science, and has more recently been applied to fisheries research and management including plans in Alaska (Merritt and Criddle 1993, Merritt 1995, 2000, 2001, Merritt and Skilbred 2002, USFWS 2005; KRSA 2007; Mat-Su Partnership 2008).

AHP provides a comprehensive and rational framework for structuring a decision problem, representing and quantifying its elements, relating those elements to overall goals, and evaluating alternative solutions. Complex problems are broken into elements comprising a hierarchy. The structure relates elements in lower levels to higher levels and prioritizes elements based on judgments. Judgments are used to compare the relative importance (or preference) of elements within a group, in the context of the element at next higher level.

Breaking a complex problem into levels permits decision makers to focus on smaller sets of decisions, improving their ability to make accurate judgments and encouraging people to explicitly state their judgments of preference or importance. Defined criteria ensure that decision makers use the same considerations in thinking about relative importance or priority. The process then synthesizes all the weights of importance assigned in the hierarchy into a ranked set of options. The ranking reflects the importance of the option, relative to its issue and objective, and ultimately the goal it addresses. In imbalanced hierarchies, an adjustment feature is used to restore priorities to their intended proportion of weight.

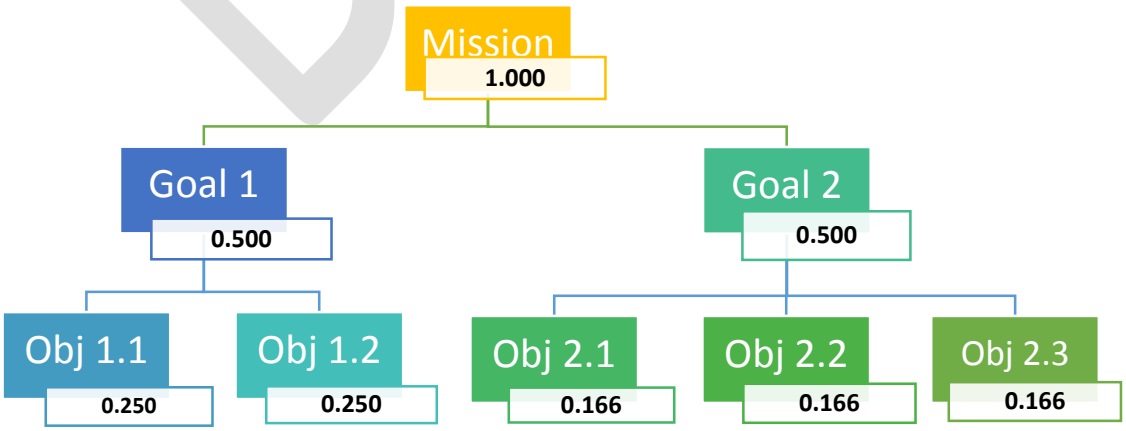

Figure 4. Example of an unadjusted AHP hierarchy with global default priorities.

Workshop / Stakeholder Group

The ideal group size for decision making is about 12-15 people; larger groups may fall victim to "groupthink", which can decrease individuality and creativity during discussions. Viewpoints represented should be approximately equivalent to foster a feeling of fairness during the prioritization phase. Sufficient expertise in describing issues comprising the complex problem, and in generating options to address issues, should be contained within the Stakeholder Group; however, too much overlap in expertise for a given topic may bias discussions towards one way of thinking about issues. If stakeholders wish, they can bring "experts" with them to consult with during planning and prioritization, however, the extra people will not be asked for their priorities, in an effort to keep the group to a manageable size.

It is vital that no key interest category, or stakeholder within a category, is inadvertently excluded from the invitation list that has either critical information on issues that describe the problem (or options that can address the problem); or, the influence to disrupt implementation of the planning outcome by claiming their absence invalidates the plan.

The Core Planning Team identified stakeholder interest categories for invitation to the planning workshop, corresponding backgrounds, and the possible number of people needed to represent that category's spread of influence and expertise.

Ranking Priorities

Plan elements are prioritized based on group judgments. Priorities were established for goals and objectives by the Commission and the Core Planning Team. Priorities were established for issues by stakeholder workshop participants.

To make comparisons of relative importance among plan elements, in consideration of their "parent" node, criteria were established by the Core Planning Team as standards for measurement. Criteria help to discriminate among concepts. Judgments made according to criteria are then used to compare the relative importance of elements within a group.

A positive 1-9 ratio scale with verbal definitions is used for rating the importance among elements, where 9 is extremely important. Unimportance can be expressed in a positive inverse ratio scale, where $1/9^{th}$ is extremely unimportant. A scale of nine units reflects the degree to which people can reasonably discriminate the intensity of relationships between elements. A ratio scale measures magnitude; i.e., where one element is "twice as much" or "three times as much" when compared with another element. Numbers between those listed (e.g., 2, or 2.5, etc.) are used to interpolate meanings as a compromise. Unimportance is expressed in a positive inverse ratio scale, where the reciprocal 1/9 is defined as extremely unimportant.

Elements judged to be of equal importance are given equal scores. Consensus on the rating of elements is defined as within a range of two to three points.

Table 3. Positive ratio scale used to rate relative importance of plan elements.

Scale of Importance	Magnitude	Definition
9	Nine times as much	Extreme importance
7	Seven times as much	Very strong importance
5	Five times as much	Strong importance
3	Three times as much	Moderate importance
1	About the same	Slight importance

Individual judgments are then combined into a group solution. In combining individual judgments, it is assumed that everyone's judgments are consistently made using the same criteria. Dissent and debate are encouraged. Debate allows one to explore alternative viewpoints and gain new knowledge. To be successful, debate must lead to cooperation and agreement. Debate of ideas and an exchange of information promotes learning among the group, resulting in edits to elements that clarify the meaning of concepts. Debate should bring judgments closer together. A well-informed person can effect change in belief.

Individual scores are combined into a group score using the geometric mean. The geometric mean is the appropriate method for combining judgments made on a ratio scale. The geometric mean is used to resolve differences of opinion when consensus is lacking. Because a mean score can mask extremes, we also record the spread of scores.

Decision support software, Microsoft Excel and Expert Choice, is used to synthesize all the weights of importance assigned to elements in the hierarchy into a ranked set. The software was used interactively to depict the influence of weights of relative importance and derive priorities Derived priorities of elements in a hierarchy proportionally add up to their whole, 1.000.

Rank order of an element is determined from the weight of importance assigned to its "parent node" in the next higher level, as well as its weight of importance in relation to other elements under the parent (its "siblings").

Because objectives had unequal numbers of issues, the hierarchy was unbalanced. Structural imbalance in the hierarchy can lead to dilution of the weight of many issues under a single objective, so an adjustment feature in Expert Choice was used to restore priorities to their respective proportion of weight. In a conceptual example, consider that if an objective (A) has four issues, and another objective (B) has two issues, then there are six issues in all and structural adjusting multiplies A's priority by 4/6 and B's by 2/6. Thus, the overall priorities for A's issues are not diluted simply because there are many of them.

III. GOALS & OBJECTIVES

Identification and Ranking Methods

The core planning team met on August 28, 2014 in Anchorage and on September 18, 2014 in Palmer to develop goals and objectives for the RM&E plan. On December 18, 2014, the core planning team participated with Commission members in a facilitated discussion in Palmer to establish priorities among goals, and objectives within each goal, using AHP.

The core planning team identified a set of five criteria to use in making comparisons of relative importance, so that everyone's judgments were consistently made using the same standards. A key component of the criteria was the "State of the Knowledge Summary" (Summary) that resulted from the Gap Analysis. The Summary distilled a comprehensive inventory of published technical information relating to goals and objectives in the RM&E plan into an assessment of the state of knowledge, partitioned into four possible categories: extensive, moderate, limited or sparse. The core planning team relied on two highly-valued criteria derived from the Summary in making judgments of importance. The set of criteria was posted and referred to repeatedly during the day. Relative importance was judged according to the advantage that the goal or objective presented in:

Table 4. Criteria for assessing the relative importance of goals and objectives.

Category	Criteria	Value
State of Knowledge	Obtaining knowledge through research that will make a significant contribution to Mat-Su salmon in UCI.	High
	Obtaining knowledge through research to fill an information gap needed for managing, protecting and improving Mat-Su salmon stocks in UCI.	Mid-High
Feasibility and Cost Effectiveness	Obtaining cooperative funding and partnership opportunities.	Medium
	Obtaining benefits per cost or effort that are useful to achieving the RM&E plan's mission.	Medium
	Obtaining a high likelihood of success or effectiveness to achieving the RM&E plan's mission.	Medium

Goals

Using the above criteria as guidelines, the core planning team used their expert judgment to individually assign ratings of importance to the three goals (entitled "Salmon Status", "Salmon Fisheries" and "Salmon Ecosystem") relative to achieving the Mission. Participants were given time to think and to share their verbal judgments with others. Priorities and their rationale are provided below.

Table 5. Goals and their relative priorities in the RM&E plan.

Level 1-Mission	Level 2-Goals
1.000 Strategic Plan Develop a strategic plan that encompasses the interests of partners and governing agencies in guiding funds towards research, monitoring and evaluation projects selected to manage, protect and improve Mat-Su Borough salmon stocks for optimum benefits while maintaining biological productivity and diversity.	**0.375** Goal 1. Salmon Status Provide information on salmon stock, abundance, productivity and biology necessary to quantitatively assess status and trends relative to historical benchmarks and numerical goals.
	0.329 Goal 2. Salmon Fisheries Provide information on salmon fisheries to manage for sustainability and optimum use.
	0.295 Goal 3. Salmon Ecosystem Provide information on ecosystem and human processes, effects and perturbations that limit or threaten salmon sustainability and optimum use.

In regards to the goal "Salmon Status", the core planning team believes that a primary benefit to obtaining more complete knowledge on salmon stock identification, characteristics, abundance and productivity is a more effective management system. Thus, there is a sequence of priority that needs to occur: obtaining information to achieve the goal, "Salmon Status", facilitates achieving the goal, "Salmon Fisheries." For example, obtaining information to establish an escapement goal that is currently lacking would make a significant contribution to Mat-Su salmon in UCI. Following discussion, the core planning team assigned a mean rating of 0.375, ranking this goal as the highest priority.

In regards to the goal "Salmon Fisheries", the core planning team believes that fisheries are being managed without key information. As a result, controversies arise. Obtaining key information to develop new tools, or enhance existing tools, would be a significant contribution to increasing the effectiveness of the fisheries management system. Following discussion, the core planning team assigned a mean rating of 0.329, ranking this goal second in priority.

In regards to the goal "Salmon Ecosystem", the core planning team centered their discussions around the topic of aquatic habitat. The majority of the core planning team agrees that a large investment to obtain additional knowledge about the state of aquatic habitat for salmon in the

Mat-Su Borough is not warranted because t the Mat-Su Fish Habitat Partnership has done a good job of addressing habitat issues in the Mat-Su Borough. Extensive work by the Mat-Su Fish Habitat Partnership is already addressing habitat concerns. With some localized exceptions, the Mat-Su Borough's salmon habitat "is in pretty good shape" because the footprint of human impact is relatively limited (see Figure 5), compared to pristine habitat available throughout the watersheds. The core planning team is aware that a large amount of money ($900,000) has been set aside for culvert replacement in the Mat-Su Borough; they debated the benefits of restoring 10 miles of stream access versus using limited funds to obtain information that is critically needed for conservation of stocks of concern in the Mat-Su Borough. While one person pointed out that we could always better evaluate the impacts of habitat alterations on salmon, others argued that these evaluations have already been instituted, and furthermore, other funding sources are being used for this purpose. Following discussion, the core planning team assigned a mean rating of 0.296, ranking this goal third in priority.

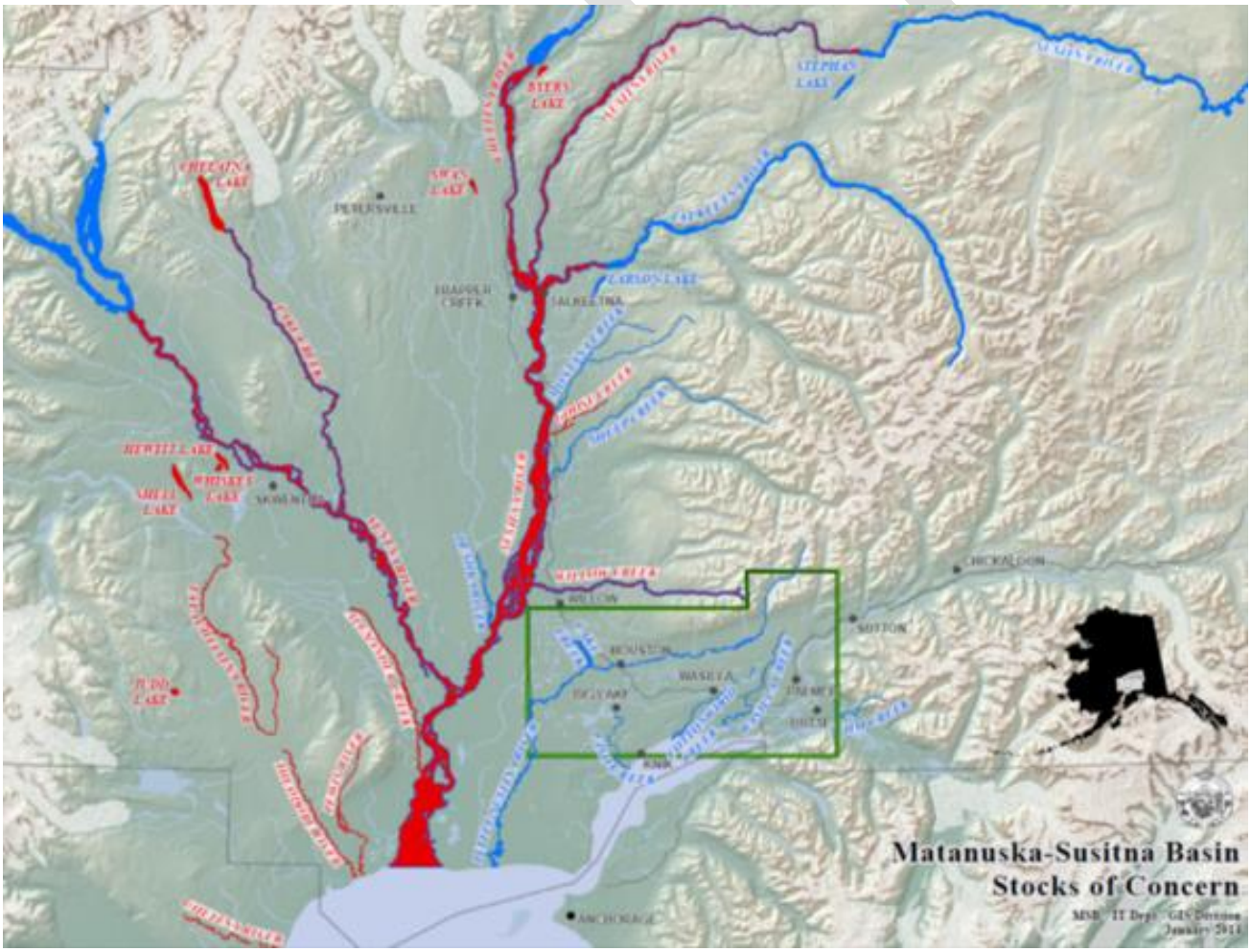

Figure 5. Distribution of salmon stocks of concern relative to the primary area of rural development in the Matanuska-Susitna Borough.

Objectives

Using the above criteria as guidelines, the core planning team used their expert judgment to individually assign ratings of importance to objectives relative to achieving their goal. Numbers identifying objectives were re-assigned following prioritization. Priorities and their rationale are provided below.

Table 6. Objectives and their relative priorities for the RM&E plan.

Level 2-Goals	Level 3-Objectives
0.375 Goal 1. Salmon Status Provide information on salmon stock abundance, productivity, and biology necessary to quantitatively assess status and trends relative to historical benchmarks and numerical goals.	**0.100** Objective 1.1. Biological Reference Points Integrate information on stock identification, status and productivity to determine quantitative benchmarks/escapement goals suitable for monitoring/evaluating trends and optimizing productivity. *e. g. sustainable, biological, optimal escapement goals. Maximum yield, maximum production, capacity, conservation concern levels.* **0.096** Objective 1.2. Stock Abundance Estimate relative and/or absolute abundance of representative stocks or populations. *e. g. adult escapement, juveniles or smolts, age, sex, length, assessment methods, standards for escapement estimation.* **0.089** Objective 1.3. Stock Identification Describe distribution and stock structure of each salmon species. *e. g. distribution by life stage, genetic stock structure, population identification, migratory timing.* **0.060** Objective 1.4. Stock Productivity Determine production, survival and/or replacement rates relative to spawning escapement and other limiting factors. *e. g. stock-recruitment productivity and capacity, life stage survival.* **0.030** Objective 1.5. Biology Describe characteristics of salmon species. *e. g. Life History, ecology, food habits, habitat requirements, physiology.*
0.329 Goal 2. Salmon Fisheries Provide information on salmon fisheries to manage for sustainability and optimum use.	**0.090** Objective 2.1.Economic & Social Values Assess the economic and social values associated with sport, commercial and personal use fisheries. *e. g. expenditures, revenues, ex-vessel values, wholesale value, markets, traditional utilization.* **0.088** Objective 2.2. Management Strategies& Tools Evaluate the effectiveness of existing and alternative management strategies and tools. *e. g. forecast accuracy, in-season run strength assessment, gear, time & area effects, management effectiveness, regulatory inconsistency, enforcement, conservation corridors.*

Level 2-Goals	Level 3-Objectives
	0.063 Objective 2.3. Harvest Estimate amount/composition of harvest for each fishery. *e. g., species/stock composition, age/sex/length, exploitation rate, incidence of catch-and-release or drop-off mortality catchability, selectivity, numbers and pounds caught, catch per effort.* **0.052** Objective 2.4 Hatchery Enhancement Provide information on hatchery enhancement effectiveness and opportunities consistent with salmon sustainability and optimum use. *e. g. production, hatchery practices, costs, returns, fishery contributions, cost recovery, wild fish interactions, evaluation criteria.* **0.036** Objective 2.5. Participation Characterize effort and composition of participants in each fishery. *e. g. numbers of permits or licenses, number and origin of participants, effort (angler days), trips per participant, trip length, access.*
0.295 Goal 3. Salmon Ecosystem Provide information on ecosystem and human processes, effects and perturbations that limit or threaten salmon sustainability and optimum use.	**0.071** Objective 3.1. Ecological Interactions Evaluate interactions and impacts of animal and plant species on salmon production and trends. *e. g. primary/secondary aquatic productivity, trophic interactions, competition, predation, invasive species (pike and Elodea), beavers, disease, parasites.* **0.067** Objective 3.2. Human Factors Evaluate status and effects of human development and activities on salmon production and trends. *e. g. land & water use, large scale development, culverts/passage, pollution, climate change, regulation & compliance, protection & restoration action effectiveness.* **0.060**Objective 3.3. Aquatic Habitat Conditions Characterize quantity and quality of freshwater and estuarine habitats which affect salmon production. *e. g. River, stream and lake physical characteristics, water quality and quantity.* **0.049** Objective 3.4. Marine Ecology Evaluate ecology and habitat conditions and influences of the near- and offshore marine environment in UCI on salmon production and trends. *e. g. temperature and circulation patterns, anomalies, productivity, environmental cycles & regimes.* **0.049** Objective 3.5. Landscape and Watershed Evaluate landscape, watershed, wetland, riparian, and hydrological factors which affect freshwater salmon habitat conditions. *e. g. characterization, function and/or analysis of landscape, watershed, wetland, floodplain, hydrology, sedimentation.*

Objectives under Goal 1, Salmon Status

In considering the five objectives under Goal 1, "Salmon Status", the core planning team engaged in lengthy discussion. Escapement goals are established only by ADFG or the Board of fisheries, and are typically based on a broad category of Biological Reference Points which identify population parameters such as maximum yield or production. The planning group agreed that being able to establish Biological Reference Points requires knowledge about stock status, stock identification and productivity, so the objectives are linked. It was pointed out that Biological Reference Points are an outcome of stock status research and productivity assessments. There is limited information at this time to establish Biological Reference Points for stocks of chum, coho and sockeye salmon in Mat-Su Borough waters. Ultimately, obtaining knowledge to establish Biological Reference Points (Objective 1.1) was rated the highest in priority for achieving the goal (mean priority of 0.100).

The core planning team thought that basic estimates of stock abundance (Objective 1.2, a mean priority of 0.096) and stock identification (Objective 1.3, a mean priority of 0.089) were the next highest priorities. With respect to stock identification, a key question is whether the limited number of stocks or populations that are monitored for some Mat-Su salmon are representative of all or just a portion of the run of each species.

Productivity (Objective 1.4, a mean priority of 0.060) will be better understood once more knowledge about stock abundance and stock identification is acquired. All members agreed that significant information about general salmon biology (Objective 1.5) is available and this objective is deemed of lesser importance (a mean priority of 0.030) than assessing status and trends of Mat-Su salmon in UCI

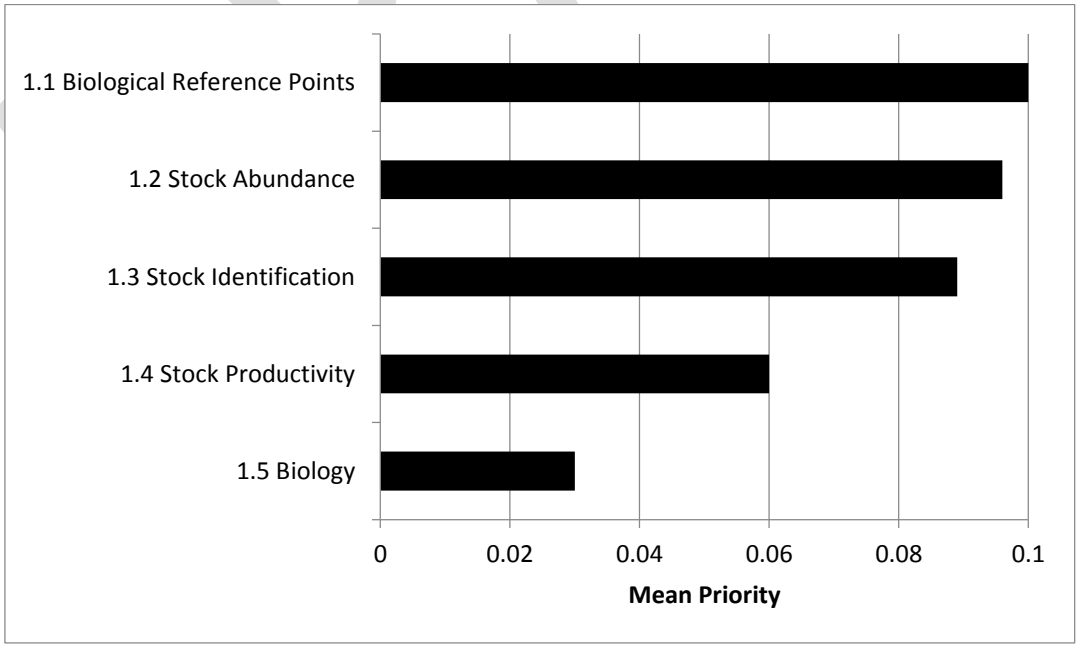

Figure6. Rank of objectives under Goal 1: Salmon Status.

Objectives under Goal 2, Salmon Fisheries

In considering the five objectives under Goal 2, "Salmon Fisheries", the core planning team agreed that a lot of decision-making in allocation to optimize the benefits of diverse fisheries revolves around the outcomes of research on economic and social values (Objective 2.1). For example, the economic significance of sport and personal use fishing to the Mat-Su Borough is widely referenced in relation to job growth, local and state tax revenue, and funding allocation. Thus, the group favored periodic updates of research on the value of fishing in Upper Cook Inlet. However, some members questioned whether an alternative agency, such as ADFG, should allocate funds for such a study? Members were informed that while the intent of ADFG is to conduct an economics study related to Cook Inlet salmon every 5 years, they have only produced one. At the present time, ADFG is looking into conducting another economics assessment of salmon specific to Cook Inlet, but there is no firm commitment. Given the significant contribution to the Mat-Su Borough of research on the economic and social values of salmon fishing, and, the uncertainty of alternative funding sources, the core planning team rated this objective as the highest priority (mean priority of 0.090) for achieving the goal.

The core planning team acknowledged that obtaining information to develop and evaluate management tools – such as conservation corridors or net mesh size and depth - would have a substantial influence on abundance and composition of salmon returning to the Mat-Su Borough. In fact, looking at the overall effectiveness of current management strategies and tools (Objective 2.2), and different ways of doing things, would likely lead to high benefits. As an example, one person highlighted the potential value of a model for analyzing the effects of alternative salmon management strategies on harvest, allocation and escapement in UCI. The core planning team rated Objective 2.2 second highest in importance (mean priority of 0.088) to achieving the goal.

The core planning team noted that there is extensive information about the number of salmon harvested in each UCI fishery (Objective 2.3). However, one person pointed out that information was quite limited on catch and release mortality by sport anglers and incidental fishing mortality from gill nets due to drop out. Accordingly, the group rated this objective third highest in priority (a mean priority of 0.063).

In regards to research relating to hatchery enhancement (Objective 2.4), the group noted that ADFG has received a lot of funding on enhancement: 2 million dollars in the FY2014 capital fund allocation for Susitna River salmon research, restoration & enhancement. The group questioned whether funds for salmon enhancement efforts in UCI would be dedicated primarily to production, as in the past, or whether significant evaluations of enhancement efforts would also be included? The group was informed that basic evaluations of existing enhancement programs are underway - 100% of juvenile chinook released from hatcheries into Willow, Ninilchik and other streams are marked in some way, for example adipose fin clips, otolith marks or coded wire tags. In the end, the group considered that ADFG has funds for hatchery enhancement; and, there are uncertain benefits (salmon survival) to costs of hatchery operations. So, the group gave this objective a mean priority of 0.052.

All members agreed that significant information on fishery participation (Objective 2.5) is available, so this objective was deemed as having the least importance (mean priority of 0.036) to achieving sustainability and optimum use.

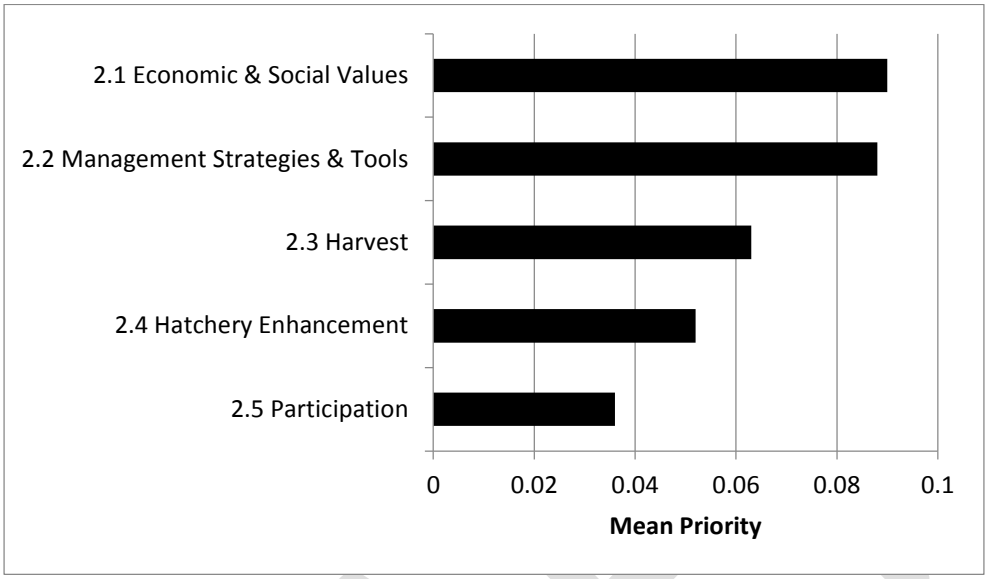

Figure 7. Rank of objectives under Goal 2: Salmon Fisheries.

Objectives under Goal 3. Salmon Ecosystem

In considering the five objectives under Goal 3, "Salmon Ecosystem", one member mentioned the recent controversies surrounding Mat-Su salmon that relate to ecological interactions (Objective 3.1), such as predation from northern pike and habitat alterations from the lake-choking invasive weed, elodea. Others noted that there are opportunities for partnership and cooperative funds to address these types of ecological interactions, such as with the Mat-Su Fish Habitat Partnership and ADFG. In fact, ADFG is currently working on several aspects of ecological interactions relating to salmon, including an experimental pike suppression program in Alexander Creek. Another member who favored research on ecological interactions said that looking at interactions and impacts of animal and plant species on salmon production and trends was something tangible, in contrast to research on ecological processes. Finally, the I Summary revealed that ecological interactions have only recently begun to receive attention. As a result of these arguments, the core planning team rated this objective high in priority (mean priority of 0.071) for achieving the goal.

Considering Objective 3.2, Human Factors, several members noted that human factors are already getting a lot of attention through the Mat-Su Fish Habitat Partnership. There can be limited benefit for the cost because other funds are directed towards these types of evaluations. For example, a large amount of money ($900,000) has been set aside for culvert replacement. While not all issues relating to human factors are currently being addressed, still, they have been identified in the Mat-Su Fish Habitat Partnership plan. Others pointed out that UCI is experiencing impacts from humans in many forms, from development to fishing. Furthermore, research on the

effects of human factors on salmon production and trends is deemed important by stakeholders and politicians. Protecting healthy salmon habitats from significant human impact will be key to the long term health of salmon runs and fisheries. With these points in mind, the group gave a relatively high priority (mean priority of 0.067) to this objective.

Reiterating earlier sentiments, the majority of the core planning team agrees that the state of the aquatic habitat (Objective 3.3) in the Mat-Su Borough "is in pretty good shape". Substantial information has been developed on aquatic habitat conditions. Additionally, they believe that the Mat-Su Fish Habitat Partnership has done a good job of addressing salmon habitat issues in the Mat-Su Borough. Therefore, the group gave a priority score of lesser importance (mean priority of 0.060) to this objective.

Some information is available on marine ecology (Objective 3.4) in UCI but gaps remain. The marine environment in UCI may have a significant effect on variability and trends in returns of salmon to Mat-Su streams. However, some questioned if studying the effects of marine conditions in UCI on salmon production is outside the scope of the RM&E plan given that marine research "gets very expensive." The group assigned a mean priority of 0.049 to this objective due to the potential low cost effectiveness of investments of resources, but recognized the potential value of a better understanding of marine ecology in UCI on Mat-Su salmon.

In regards to landscape and watershed conditions and processes (Objective 3.5), one person pointed out that understanding related processes is important to long term protection of aquatic habitats, but studies may not have immediate application to salmon production issues. . Substantial information already exists on many aspects of landscape, watershed conditions and processes in the Mat-Su region from efforts relating to the Susitna-Watana Hydro project and projects funded by the Mat-Su Fish Habitat Partnership and ADFG. Accordingly, the group gave this objective a mean priority of 0.049.

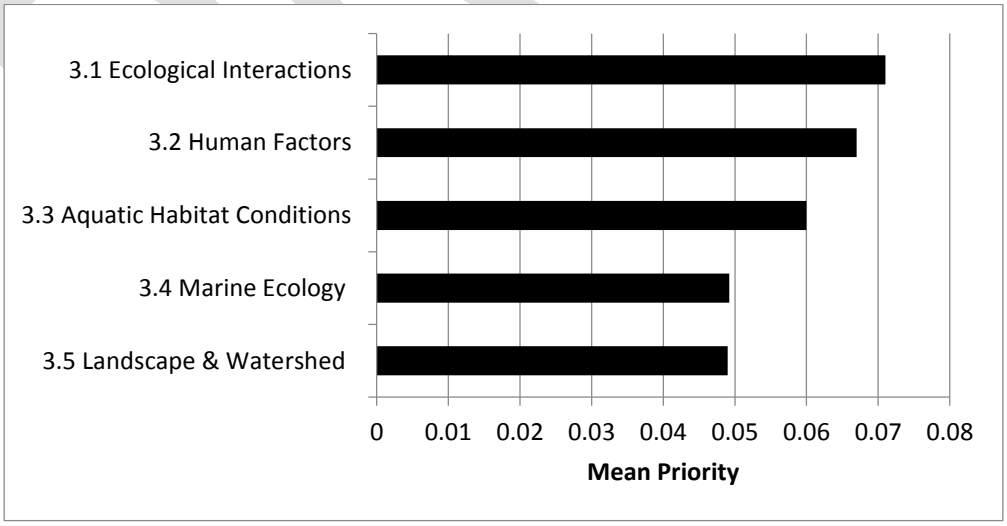

Figure 8. Rank of objectives under Goal 3: Salmon Ecosystem.

MISSION		GOALS		OBJECTIVES	
1.000	Develop a strategic plan encompasses the interests partners & governing in guiding funds towards research, monitoring & evaluation projects to manage, protect & Mat-Su Borough stocks for optimum benefits while maintaining biological productivity and diversity.	**.375**	1. Salmon Status Provide information on stock abundance, productivity & biology necessary to quantitatively assess status & trends relative to historical benchmarks & numerical	**.100**	1.1 Biological Reference Points Integrate information on stock identification, status productivity todetermine quantitative benchmarks/ escapement goals for monitoring/evaluating trends optimizing productivity.
				.096	1.2 Stock Abundance Estimate relative &/or absolute abundance of representative stocks or populations.
				.089	1. 3 Stock Identification Describe distribution and stock structure of each species.
				.060	1.4 Stock Productivity Determine production, survival &/or replacement relative to spawning escapement & other limiting
				.030	1.5 Biology Describe characteristics of salmon species.
		.329	2. Salmon Fisheries Provide information on fisheries to manage for sustainability & optimum use.	**.090**	2.1 Economic & Social Values Assess the economic & social values associated with sport, commercial & personal use fisheries.
				.088	2.2 Management Strategies& Tools Evaluate the effectiveness of existing & alternative management strategies & tools.
				.063	2.3 Harvest Estimate amount/composition of harvest for each
				.052	2.4 Hatchery Enhancement Provide information on hatchery enhancement effectiveness &opportunities consistent with salmon sustainability &optimum use.
				.036	2.5 Participation Characterize effort & composition of participants in each fishery.
		.296	3. Salmon Ecosystem Provide information on ecosystem & human effects & perturbations that limit or threaten salmon sustainability & optimum use.	**.071**	3.1 Ecological Interactions Evaluate interactions & impacts of animal & plant on salmon production & trends.
				.067	3.2 Human Factors Evaluate status & effects of human development & activities on salmon production & trends.
				.060	3.3 Aquatic Habitat Conditions Characterize quantity & quality of freshwater & habitats which affect salmon production.
				.049	3.4 Marine Ecology Evaluate ecology & habitat conditions & influences of near- and off-shore marine environment in Upper Inlet on salmon production & trends.
				.049	3.5 Landscape & Watershed Evaluate landscape, watershed, wetland, riparian & hydrological factors which affect freshwater salmon habitat conditions.

Figure 9. Global priorities of goals and objectives developed by the core planning team on December 18, 2014.

IV. STATE OF KNOWLEDGE SUMMARY

Information gaps for goals and objectives were identified based on a preliminary assessment of the state of knowledge for goal and objective subjects identified in the draft research plan. This assessment is based on a qualitative assessment of quantity and quality of the available published and unpublished technical information and will be subject to refinement based on continuing planning discussions.

Assessment Categories

A) Extensive: This subject has been or is being addressed in a comprehensive fashion by a number of well-designed studies. There is little uncertainty regarding this subject. Findings have been extensively reviewed and corroborated by complementary efforts. Work has found direct application through the identification of alternatives and implication of significant actions. The existing information provides sufficiently meaningful and timely guidance to policy makers and resource managers. While additional work might be done, the marginal contribution to related actions or alternatives is relatively modest in relation to past work. Substantial consensus exists on the implications and outcomes associated with the available information on this subject.

B) Moderate: Significant information is available but it is incomplete. Significant uncertainty remains. Findings may not have been extensively reviewed and corroborated by complementary efforts or contradictory results are unresolved. Information may need to be updated or existing studies may need to be improved to give better guidance to resource managers. The existing information provides only partial guidance to policy makers and resource managers on related questions. Additional work might make a substantial contribution to related actions or alternatives in relation to past work. Disagreements exist regarding the implications and outcomes associated with the available information on this subject.

C) Limited: Some related information is available but major questions remain unanswered. Information is highly uncertain. The existing information provides inadequate guidance to policy makers and resource managers on related questions. Additional work might make a very substantial contribution to related actions or alternatives in relation to past work. Substantial disagreements exist regarding the implications and outcomes associated with the available information on this subject.

D) Sparse: Very little information is available. The existing information does not provide substantive guidance to policy makers and resource managers on related questions.

Goal 1 - Salmon Status

Table 7. Summary of the current state of knowledge regarding status of Matanuska-Susitna salmon.

Objective	Salmon Species				
	Coho	Chinook	Sockeye	Chum	Pink
1.1. Reference Points	C	B	C	D	--
1.2. Stock Abundance	B	A	B	C	D
1.3. Stock Identification	B	A	A	--	--
1.4. Stock Productivity	C	B	B	D	D
1.5. Biology	B	B	B		

Coho

Information on coho salmon is quite limited relative to their importance in Mat-Su region sport fisheries. Stock assessments are difficult for coho due to their wide distribution and run timing. Some stock assessment information is available but significant information and escapement goals are limited to only a few Knik area streams which may or may not be representative of the entire region. Genetic studies have been initiated and hold promise for identifying stock structure and harvest composition in mixed stock fisheries. However, it remains to be determined whether current and planned genetic sampling and assessments will be adequate. Stock productivity and factors driving productivity have not been effectively quantified.

Chinook

A substantial amount of information is available for Chinook salmon including time series of escapement index data and SEGs based on that data. Surveys and goals include representative populations from throughout northern Cook Inlet. Substantial efforts to identify and characterize stock structure have been undertaken in recent years based on advanced genetic methodologies. Some information exists on productivity (e.g. Deshka weir) but data have not been sufficient to identify BEGs for most populations. New work is estimating inriver run size based on fishwheel samples, smolt abundance including Coded Wire Tagging which will be sampled in the sport harvest. Marine harvest is being estimated in mixed stock commercial fisheries of Cook Inlet. Some questions remain regarding trends in productivity of marine and freshwater environments.

Sockeye

Susitna sockeye have been subject to substantial stock assessments in the Mat-Su region although substantial gaps remain. Stock structure has now been very well described with extensive genetic assessments which are now being utilized in mixed stock analyses of UCI commercial fishery data. Several escapement goals have been established but these do not appear representative of the very diverse Susitna sockeye run. Productivity is being documented based on stock-recruitment analyses and juvenile migrant sampling but substantial questions remain regarding limitations and trends in productivity.

Chum

Chum salmon stock assessments have historically received relatively little attention since UCI commercial fishery values shifted in favor of sockeye. No escapement goals are established for the Mat-Su region. Stock structure has not been subject to substantial investigation in UCI. More recently, chum salmon abundance was estimated in 2010-2012 based on fish wheel studies in the Susitna and Yentna rivers.

Pink

Very limited data is available for pink salmon in UCI due to their relatively high abundance and limited importance in current commercial and sport fisheries. No escapement goals have been identified.

Goal 2 - Salmon Fisheries

Table 8. Summary of the current state of knowledge regarding fisheries for Matanuska-Susitna salmon.

Objective	Sport			Personal Use	Commercial	
	Coho	Chinook	Other		Drift	N. Set
2.1. Economic & Social Values	B	B	B	C?	A	A
2.2. Management System & Tools	B	A	C?	B	C	B
2.3. Harvest	A	A	A	A	A	A
2.5. Participation	A	A	A	A	A	A
	Coho		Chinook		Sockeye	
2.4. Enhancement	B		B		--	

Economic & Social Values

Economic values of commercial fishing are well documented by ex-vessel values. Economic values of sport fishing in Alaska and the Mat-Su Borough have been assessed by studies in 2008 and 2009.

Management System & Tools

Effects of fishery regulation on the Chinook sport fishery and escapement are well understood. Substantial information exists for the coho sport fishery, personal use fishery in northern Cook Inlet, and northern district set net fishery although some questions remain. Management of northern inlet sport fisheries is considerably less intensive. The effectiveness of time and area restrictions in the Central District drift net fishery for the benefit of northern coho and sockeye remains a subject of substantial controversy.

Harvest

Harvest numbers and composition is very well documented in current sport, personal use and commercial fisheries through a statewide angler harvest survey, permit reporting and fish ticket reporting systems, respectively.

Participation

Participation in numbers is very well documented in current sport, personal use and commercial fisheries through a license sales, permitting systems, statewide angler harvest survey, permit reporting and fish ticket reporting systems, respectively.

Enhancement

Current and planned production is well-documented. Some information is available on hatchery contributions to fisheries. Information is limited on cost/benefit relationships of hatchery programs and effects on hatchery production on wild fish.

Goal 3 - Salmon Ecosystem

Table 9. Summary of the current state of knowledge regarding the Matanuska-Susitna salmon ecosystem.

Objective	Issue	Knowledge
3.1. Ecological Interactions	Aquatic productivity	B
	Pike	B
	Beaver dams/blockages	B
	Other aquatic invasive species (e.g. Elodea)	C
3.2. Human Factors (other)	Land use & development	B
	Large-scale resource development	
	Culverts	A
	Motorized off-road recreation	C
	Stormwater runoff	B
	Waste water treatment (e.g. Septic Tanks)	B
	Water withdrawals	B
	Climate change	B
3,3. Aquatic Habitat	Rivers & streams	B
	Lakes	A
	Hydrology & water quality	B
3.3. Marine Effects	Estuarine/Nearshore	B
	Cook Inlet	
	Ocean	B
3.4. Habitat Processes	Riparian	B
	Wetland	B
	Floodplain/Uplands	B

Ecological Interactions

Ecological interactions of significance to Mat-Su salmon have only recently begun to receive substantive attention. Aquatic productivity studies are being conducted in the Susitna for the Susitna Watana Hydro projects with smaller scale efforts completed in a number of other areas. Pike distribution has been partially documented and efficacy of pike suppression is being evaluated – ADFG has identified additional opportunities for experimental eradication and evaluation. Effects of beaver dams on salmon passage have been identified in a number of

systems and ADFG is conducting additional surveys in other areas. Information is more limited on new threats (e.g. Elodea).

Human Factors

Substantial information is available on other human factors affecting salmon habitats although the available material is by no means comprehensive. Large-scale development such as the potential Susitna-Watana Hydro project are subject to extensive evaluations. Land use and development is well documented although effects may be less well understood. Extensive efforts have been undertaken to inventory, characterize and remediate impacts of culverts on fish passage – ADFG has also undertaken a project to improve the existing culvert prioritization process to optimize benefit from fish passage dollars as available. ATV crossings, storm water runoff, wastewater treatment, and water withdrawal have been partially addressed by a number of assessments and plans but opportunities for additional work exist. Climate change is generally being addressed at a more regional scale.

Aquatic Habitat

Substantial information has been developed in recent years on aquatic habitat conditions within the Mat-Su region through the efforts of the Habitat Partnership as well as the Susitna-Watana Hydro projects. River and stream habitats have been mapped in the Susitna and Matanuska rivers with a combination of LiDAR, orthoimagery and ground surveys. Extensive information has been collected on lakes, particularly large sockeye-producing systems. Significant information is also available regarding hydrology and water quality (including temperature and contaminants) is selected systems. Habitat information may be incomplete for representative and at-risk systems throughout the basin.

Landscape & Watershed

Substantial information has been developed in recent years on aquatic habitat conditions in areas of the Mat-Su region through the efforts of the Habitat Partnership as well as the Susitna-Watana Hydro projects. Extensive riparian and wetland mapping and assessment work has been completed for many areas, particularly in the Susitna. A need for addition work has been identified to synthesize and augment work conducted by various agencies and organizations to identify priorities and provide guidance for future protection and restoration activities (Hughes 2013).For instance, ADFG is conducting related work for wetlands.

Marine Ecology

Substantial information has been developed in recent years identifying estuary habitats throughout the Knik arm and evaluating the status of each. Some information exists on environmental conditions in Cook Inlet. Information on environmental conditions in salmon habitats in the Gulf of Alaska and Bering Sea is available from large-scale monitoring efforts largely overseen by the National Marine Fisheries Service. Effects of marine conditions in UCI and the ocean on Mat-Su salmon are only partially understood.

V. ISSUES & OPTIONS

Identification & Ranking Methods

The Core Planning Team identified stakeholder interest categories for invitation to the planning workshop and the number of people needed to represent that category's spread of influence and expertise. Stakeholders indicating they were able to attend the workshop were sent preparation materials, including a handout that contained: and introduction to the planning process, term definitions, training in the AHP, an explanation of the plan's mission, goals and objectives, criteria for judging importance, and an invitation to bring a list of salient issues and possible options for each objective. Their primary task was to use expert judgment to identify and prioritize issues that are currently impeding the achieving of objectives, such as incomplete knowledge, uncertainty, and difficulties that need to be overcome. A secondary task was to brainstorm for possible options (project ideas) that could be implemented to address issues.

The workshop was held on January 21 and 22, 2015 in Palmer. Of 19 stakeholders invited, 14 were able to attend. A complete list of workshop attendees can be found in the Appendix.

Table 10. Stakeholders invited to the planning workshop.

Interest	Background	Number of people
Mat-Su Borough &Fish and Wildlife Commission	Business, Sport fish, Personal Use	3
ADFG	Sport fish, Habitat, Commercial fish	3
Board of Fisheries Advisory Committees: Mat Valley & Susitna Valley	Sport fish, Business, Habitat, Commercial fish	2
Mat-Su Borough local government	Politics, Business, Habitat	1
Mat-Su Salmon Habitat Partnership	Habitat	1
USFWS	Habitat & Fisheries	1
NMFS	Marine waters	1
Cook Inlet Aquaculture	Enhancement & Monitoring	1
Northern District Setnet Fishery	Commercial fish	1
Central District Driftnet Fishery-UCI Drift Association	Commercial fish	1
East Side Setnet Fishery -Kenai Peninsula Fisherman's Association	Commercial fish	1
Native Community-Chickaloon Village Traditional Council	Subsistence	1
Private non-profit	Environment, Monitoring	2
		Total 19

On the first day of the workshop, participants were introduced, the purpose of the meeting and reference material were reviewed, and the planning process and funding source were explained. To use time efficiently, participants were asked to self-select one of three workgroups to join, representing the three goals of the plan: Salmon Status, Salmon Fisheries and Salmon Ecosystem. Participants joined workgroups based on their interest and expertise; people were free to sit in

on all workgroups if they so desired. Moderators guided workgroups in articulating issues and possible options systematically by objective, which were written on flip chart pages. In the afternoon, everyone reconvened and each workgroup shared summarized results, allowing others to comment upon or add issues and options. In this manner, a total of 55 issues and 102 options were generated on the first day of the workshop. At the end of the day, an exercise in rating the importance among issues relative to their objective was undertaken to prepare the group for prioritization on the following day. On the second day of the workshop, criteria for judging relative importance among issues under each objective were reviewed and posted (see Table 4). One additional criterion – knowledge is sequential in nature – was added to the list. A professional facilitator led the entire group in using AHP to state their judgments of relative importance. Time was taken to discuss differences of viewpoint, which allowed an exchange of ideas, resulting in learning and at times changes in ratings of importance to more closely reflect a person's newly-gained knowledge. Group discussion also clarified the wording of issues (e.g., edits were made) and refined their organization within the hierarchy (e.g., similar issues were combined and others moved under more appropriate objectives). The group succeeded in discussing all issues under the three goals and completing judgments of importance among issues by the end of Day 2. Options for issues were identified during the workshop, but were not rated for importance.

Goal 1 Issues by Objective

A total of 22 issues were described for Objectives 1.1 through 1.4. The workgroup decided that there were no salient issues for Objective 1.5 Biology that were not already addressed under the other objectives for that goal. Thus, the weight of importance for that objective was appropriately re-distributed among the remaining four objectives under Goal 1. Issues were classified as either pertaining to specific salmon species or all salmon.

Table 11. Issues and options identified for Objective 1.1 Biological Reference Points.

Level 3: Objective 1.1 Biological Reference Points Integrate information on stock identification, status and productivity to determine quantitative benchmarks/escapement goals suitable for monitoring/evaluating trends and optimizing productivity.
Level 4: Issues with Example Options
1.1.1. Coho-Knowledge is insufficient to establish escapement goals for Susitna coho; existing escapement goals in the Knik system may not represent the status of coho in the Susitna system. *Suggested options:* *a. Identify alternative benchmarks for use as interim reference points.* *b. Develop additional goals for representative populations from existing or new information.* *c. Use mark recapture estimates of total abundance.* *d. Conduct inseason monitoring of escapement with sonar, weir, fishwheel, etc.*
1.1.2. Chinook-Because knowledge is insufficient to establish BEGs for Susitna Chinook, only SEGs are established; thus, assessment needs to be improved in order to identify BEGs that provide the greatest potential for maximum sustained yield and production. *Suggested options:* *a. Collect additional data on ASL and harvest apportionment.* *b. Conduct more quantitative assessments than the current single aerial survey.*
1.1.3. Sockeye-The historical baseline of sockeye escapement in the Susitna is unknown; current SEGs may not be representative of existing sockeye status and diversity. *Suggested options:* *a. Use genetic analysis of scales collected in the commercial fishery to revise run reconstruction; conduct a retrospective analysis.* *b. Evaluate adequacy of goals relative to sockeye distribution and genetic stock structure.* *c. Monitor major sockeye escapements in the Susitna inseason with sonar, weir, etc.* *d. On an annual basis, monitor smaller sockeye escapements in the Susitna.*
1.1.4. All salmon-No basis for instituting sustainable escapement thresholds (SETs) has been developed, thus no SETs have been established. There may be instances where SETs are applicable (e.g., Shell Lake).Without a technical basis for establishing a trigger point, there is no process for identifying conservation concerns which trigger substantive actions even in cases of obvious need. *Suggested options:* *a. Develop and apply a systematic approach to SET identification based on the best available science (e.g., ESA guidance).*
1.1.5. Pink-No biological reference points have been identified for pink salmon in UCI. *Suggested options:* *a. Identify an appropriate framework or approach for identifying benchmarks or goals for pink salmon escapement in the Susitna (e.g., existing data, new data).* *b. Identify the genetic stock structure of pinks to provide a basis for selecting units for assessment.* *c. Implement or adapt annual pink monitoring.*
1.1.6. Chum-No biological reference points have been identified for chum salmon in UCI. *Suggested options:* *a. Identify an appropriate framework or approach for identifying benchmarks or goals for chum salmon escapement in the Susitna (e.g., existing data, new data).* *b. Identify the genetic stock structure of chums to provide a basis for selecting units for assessment.* *c. Implement or adapt annual chum monitoring.*

Under Objective 1.1, Biological Reference Points, the group discussed empirical estimates of production-related stock parameters (maximum yield, maximum production, capacity, etc.) and escapement goals. The strongest rating of importance (mean score of 6.4) was assigned to the issue of insufficient knowledge to establish escapement goals (or comparable management reference points) for Susitna coho salmon (Issue 1.1.1). No escapement goals have been established for any Susitna coho population. Goals have been established for a few Knik Arm streams but some people questioned whether these goals are representative of the entire species or stock due to the extent of human activities in more-developed areas of the region. The lack of escapement goals for assessing coho salmon status limits the ability to manage fisheries to ensure sustainability while also identifying and accessing harvestable surpluses.

The group assigned a strong rating of importance (mean score of 5.4) to the issue of insufficient knowledge to establish biological escapement goals (BEGs) for Chinook salmon in UCI streams (Issue 1.1.2). A number of sustainable escapement goals (SEGs) have been identified for Chinook and these appear to include representative populations throughout the watershed. By establishing BEGs for Chinook, and identifying those escapements which maximize sustainable production, fishery benefits could be potentially improved. Maximum production, rather than maximum yield, is an appropriate reference point for Chinook because UCI stocks are subject primarily to sport fishing with little commercial harvest.

The historical baseline of sockeye escapement in the Susitna is unknown (Issue 1.1.3). The group assigned a strong rating of importance (mean score of 5.3) to this issue because current SEGs may not represent the full range of diversity and status among the numerous sockeye populations in the region. Susitna sockeye have experienced an extended decline.

The group noted a lack of established sustainable escapement thresholds (SETs) for any salmon stock (Issue 1.1.4). SETs are defined in the Sustainable Salmon Policy as a point of conservation concern. Without this benchmark, there is no formal mechanism to identify stock-specific conservation concerns. There are situations where stocks have fallen to critically low levels of abundance (e. g., Alexander Creek Chinook, Shell Lake sockeye), and having a trigger for conservation action, such as a SET, would be helpful to managers. The problem is that ADFG has not described a technical basis for establishing a SET. Issue 1.1.4 was rated of moderate importance (mean score of 3.2) by the group, relative to other escapement information deficits, such as gaps in baseline knowledge of escapement. One person pointed out, “No salmon runs in Alaska appear to have disappeared because SETs were not established”.

No biological reference points (escapement goals) have been established for pink (Issue 1.1.5) or chum (Issue 1.1.6) salmon in Mat-Su waters. These issues were rated of low importance (mean scores of 2.7 to 2.8) because these species are not intensively managed and exploitation rates appear to be relatively low in relation to production capacity.

Table 12. Issues and example options identified for Objective 1.2 Stock Abundance.

Level 3: Objective 1.2 Stock Abundance Estimate relative and/or absolute abundance of representative stocks or populations.
Level 4: Issues with Example Options
1.2.1. Chinook-Substantial imprecision exists in current Chinook salmon assessment in the Susitna (single aerial flights) which reduces confidence in escapement estimates and risks failure to implement appropriate management measures to ensure that escapement goals are met. *Suggested options:* *a. Implement more rigorous, quantitative assessments (e.g., mark-recapture, weirs).*
1.2.2. Coho-Abundance information is limited for Susitna coho salmon drainage-wide as well as for representative drainages. *Suggested options:* *a. Continue annual mark-recapture estimates of total abundance for coho.* *b. Conduct annual monitoring of escapement for additional representative coho populations.*
1.2.3. Sockeye-Current abundance estimates of sockeye salmon in the Susitna do not include a representative range of existing status and diversity (weaker components of the run).Insufficient information can mask declines in abundance and diversity and result in failure to implement appropriate management actions. *Suggested options:* *a. Monitor the escapement of index sockeye populations on an annual basis and other populations on a periodic rotating schedule.*
1.2.4. Chum-Historical and current trends in chum salmon abundance in the Susitna are unknown because information on escapement is lacking. *Suggested options:* *a. Implement or adapt annual chum monitoring for representative units.* *b. Identify and implement appropriate analysis of existing information.*
1.2.5. Pink-Information on pink salmon escapement in the Susitna is lacking. *Suggested options:* *a. Implement or adapt annual pink monitoring for representative units.*

Under Objective 1.2, Stock Abundance, the group agreed that abundance information is important for monitoring status and trends in relation to limiting factors over time, and for establishing escapement goals which help guide fishery management. The group achieved a high degree of consensus regarding the relative priority of issues related to stock abundance – there was not a lot of disparity in individual scores.

A strong rating of importance (mean score of 6.5) was assigned to the issue of substantial imprecision in current Chinook abundance assessment (Issue 1.2.1). Imprecision in Chinook abundance assessment is a highly important issue because Chinook are highly valued and utilized in fisheries and they have experienced recent declines in abundance relative to historical numbers. Chinook escapements are currently monitored in a variety of streams throughout the Mat-Su region based on single aerial surveys. In addition, Chinook are counted at a weir on the Deshka River, which is one of the major populations and fisheries in the region. Aerial surveys include representative populations and provide indices of relative abundance useful for distinguishing large, average and small runs. However, reliance on single aerial surveys

introduces substantial imprecision into the Chinook assessment. Indices may be affected by annual differences in run timing and variation in stream flows which affect counting conditions.

A strong rating of importance (mean score of 6.2) was given to the issue of limited and overall insufficient abundance information for Susitna coho salmon drainage-wide (Issue 1.2.2) because of their high value and use by fishers and demonstrated declines. There is some information being developed, but information on coho abundance is limited to only a few streams or years with data. Long term data on coho abundance is available for several Knik area streams, but questions have been raised regarding how representative these sites are of the entire region. Mark-recapture studies have estimated total abundance of coho in the Susitna for several recent years but this information may not be representative of long term patterns.
The issue of limited and overall insufficient abundance information for Susitna sockeye salmon (Issue 1.2.3) was also rated strongly important (mean score of 6.0) because of their high value and use by fishers and a recent designation as a Stock of Concern by the Alaska Board of Fisheries. Abundance is currently monitored for several populations but these may not be representative of the numerous sockeye populations of varying productivity in the region. Population data is also available for a limited time period. Long-term index data is available for sockeye from Yentna sonar counts but these estimates are highly uncertain due to species apportionment problems.

A lack of information to assess abundance of chum (Issue 1.2.4) and pink (Issue 1.2.5) salmon was recognized, but rated of low importance (mean scores of 2.9 and 2.3, respectively) because of the limited fishery utilization of these species.

Table 13. Issues and example options identified for Objective 1.3 Stock Identification.

Level 3: Objective 1.3 Stock Identification Describe distribution and stock structure of each salmon species.
Level 4: Issues with Example Options
1.3.1. All salmon-There is insufficient information on the distribution and relative importance of streams for salmon in order to identify and prioritizes areas for protection from human-caused habitat disturbance. *Suggested options:* *a. Conduct surveys of additional streams that may support significant salmon production but are not currently included in the anadromous waters catalog.* *b. Analyze recent salmon radiotelementry information to identify streams utilized by salmon but are not included in the anadromous waters catalog.* *c. Identify the significance of different rivers and streams for salmon production based on relative fish abundance by life stage or inferences from habitat suitability.*
1.3.2. Coho salmon-There is insufficient understanding about the genetic stock structure of coho salmon to identify representative units and to be able to conduct mixed stock analyses for stock apportionment of the commercial harvest. *Suggested options:* *a. Collect additional information for genetic baseline, including additional populations and multi-generational sampling.*
1.3.3. Sockeye salmon-The current sockeye salmon apportionment in the commercial harvest may not provide sufficient detail on the full range of representative populations needed to evaluate status and impacts on significant subcomponents. *Suggested options:* *a. Evaluate the potential for finer scale stock apportionment relative to representative populations.*
1.3.4. Chinook salmon-A Chinook salmon genetic baseline exists for current applications but additional information is needed to distinguish some Chinook stocks in order to identify significant management units and accurately assess stock-specific fishery impacts from mixed stock analysis. *Suggested options:* *a. Collect additional information for chinook genetic baseline and mixed stock analysis as appropriate.*
1.3.5. Chum salmon-Insufficient information is available on the stock structure of UCI chum salmon to identify significant management units, assess status, and evaluate limiting factors. *Suggested options:* *a. Develop genetic stock identification tools for chum salmon in UCI.* *b. Sample and analyze chum populations throughout UCI to identify their genetic stock structure.*
1.3.6. Pink salmon-Insufficient information is available on the stock structure of UCI pink salmon to identify significant management units, assess status, and evaluate limiting factors. *Suggested options:* *a. Develop genetic stock identification tools for pink salmon in UCI.* *b. Sample and analyze pink populations throughout UCI to identify their genetic stock structure.*

Under Objective 1.3, Stock Identification, the group engaged in lengthy discussions about where salmon occur, the relative importance of different areas, how stocks are organized across their distribution, and how this organization translates into management units for the purposes of

conservation and fishery sustainability. The highest rated issue (mean score of 7.1) under Objective 1.3 is the need for more information on salmon distribution and the relative importance of streams to identify areas for protection from land use and development disturbance (Issue 1.3.1).Salmon occurrence in waters throughout the state is documented in an anadromous waters catalog (catalog). The catalog is relatively complete for larger rivers and streams but may not be well informed for smaller streams, particularly in remote areas. The catalog is updated as new information becomes available. For example, several new areas in the Susitna River above Devils Canyon have been nominated for inclusion in the catalog as a result of recent hydro licensing studies. In another example, areas have been recently added to the catalog as a result of telemetry research. One person cautioned that telemetry data is useful but typically needs to be supported with juvenile sampling of smaller tributaries. Despite ongoing efforts, the issue remains that Mat-Su streams used by salmon are likely missing from the catalog. For instance, there are several streams used by salmon in the Matanuska Valley adjacent to mine development that are not in the catalog. Another aspect of the issue is that the relative importance of river or stream reaches has not been quantified. The catalog may simply identify salmon occurrence but not use or productivity. Several options to this issue were suggested, such as linking salmon distribution to habitat condition and using GIS overlaid with habitat mapping (e.g. Nature Conservancy effort).

The need to obtain information on coho salmon genetic stock structure to identify representative units and thus conduct mixed stock analyses for stock apportionment (Issue 1.3.2) was rated strongly important (mean score of 6.5). A project is currently underway to collect genetic baseline data for coho in order to identify genetic stock structure. Additional sampling may be required to fill data gaps and then management-test applications for mixed stock analysis of fisheries.

Sockeye stock structure has been described with genetic analysis, and this information has been successfully applied to stock apportionment of the commercial fishery harvest using mixed stock analysis. However, the current sockeye apportionment may not provide sufficient detail on the full range of representative populations needed to evaluate status and impacts on significant subcomponents (Issue 1.3.3). Because sockeye populations exhibit a high degree of differentiation and home faithfully to specific locations, this feature may provide an opportunity to more finely apportion harvest among representative populations. Further investigation of this option was enthusiastically proposed. This issue was rated strongly important (mean score of 6.0).

Chinook salmon are largely harvested inriver and in Federal waters on the high seas. The current genetic stock structure baseline serves the need for stock apportionment on the high seas. However, additional genetic baseline information would be helpful for stock apportionment in the northern Cook Inlet commercial Chinook fishery, the Tyonek subsistence fishery and inriver sport fisheries (Issue 1.3.4).In particular, additional samples and markers are needed to distinguish western inlet stocks of concern from Susitna fish. Studies are underway to determine if distinguishing markers can be identified for Chinook stocks. In addition, additional baseline data is needed to distinguish the Talachulitna drainage. An incomplete baseline can result is samples being apportioned to the wrong stock unit in mixed stock analyses of harvest. The ability to use distinguishing markers would improve mixed stock analysis of harvest in UCI. While these

questions about genetic stock structure of Chinook remain, the group generally deemed their significance smaller in comparison to similar questions for coho and sockeye, so the rating of this issue was of moderate importance (mean score of 4.2).

Information is limited on chum and pink salmon distribution and little exists on genetic stock structure (Issues 1.3.5 and 1.3.6). The need to obtain information on the stock structure of pink and chum salmon to identify management units was rated relatively low in importance (mean scores of 2.8 and 2.4, respectively) due to their lower levels of exploitation in current fisheries.

Table 14. Issues and example options identified for Objective 1.4Stock Productivity.

Level 3: Objective 1.4 Stock Productivity Determine production, survival and/or replacement rates relative to spawning escapement and other limiting factors.
Level 4: Issues with Example Options
1.4.1. Chinook salmon-Existing information on Chinook salmon productivity in the Susitna is inadequate to identify stock-recruitment relationships needed to identify and manage for escapements consistent with maximum yield or production. *Suggested options:* *a. Expand the collection of ASL information needed for run reconstruction.* *b. Mark juvenile Chinook in the Susitna to estimate juvenile to adult survival.* *c. Estimate the marine harvest component.*
1.4.2. Coho salmon-Information on coho salmon productivity in the Susitna is inadequate to identify stock-recruitment relationships needed to identify and manage for escapements consistent with maximum yield or production. *Suggested options:* *a. Evaluate appropriate information to assess productivity of coho in the Susitna (abundance, ASL, stock-specific harvest based on apportionment).* *b. Mark juvenile coho in the Susitna to estimate juvenile to adult survival.*
1.4.3. Sockeye salmon-Information on sockeye salmon productivity in the Susitna is inadequate to identify stock-recruitment relationships needed to identify and manage for escapements consistent with maximum yield or production. *Suggested options:* *a. Evaluate appropriate information to assess productivity of sockeye in the Susitna (abundance, ASL, stock-specific harvest based on apportionment).*
1.4.4. Chum salmon-Information on chum salmon productivity in the Susitna is inadequate to identify stock-recruitment relationships needed to identify and manage for escapements consistent with maximum yield or production. *Suggested options:* *a. Evaluate appropriate information to assess productivity of chum in the Susitna.*
1.4.5. Pink salmon-Information on pink salmon productivity in the Susitna is inadequate to identify stock-recruitment relationships needed to identify and manage for escapements consistent with maximum yield or production. *Suggested options:* *a. Evaluate appropriate information to assess productivity of pinks in the Susitna.*

Under Objective 1.4 Stock Productivity, concerns about inadequate information on productivity was rated strongly important (mean scores of 6.8, 6.5 and 5.8, respectively) for Chinook (Issue 1.4.1), coho (Issue 1.4.2) and sockeye (Issue 1.4.3) because productivity is critical for evaluating trends in abundance and identifying optimum fishing strategies and goals. One person pointed out that information about Chinook productivity would add to the narrative about why those stocks are in decline in UCI.

While inadequate, information about productivity of chum (Issue 1.4.4) and pink (Issue 1.4.5) salmon were thought to be an issue relating more to ecology than to harvest and thus rated moderately important (mean scores of 2.6 and 2.3, respectively) one person cautioned that attention needs to be paid to these species "before the rug is completely pulled out from under us". It was hoped that projects undertaken to obtain knowledge about productivity would benefit all salmon.

Synthesis of all 22 Issues Under Goal 1

Synthesis of adjusted priorities for all 22 issues under Goal 1 resulted in a distribution of importance, where 1.1.1 lack of coho escapement goals in the Susitna is the highest ranked issue. Other important issues concern 1.2.1 imprecision in current Chinook assessment, 1.3.1 incomplete information on salmon use of streams, 1.1.2 insufficient knowledge to establish Chinook BEGs and 1.1.3 unknown baseline of sockeye escapement. Lowest ranked issues concern chum and pink salmon.

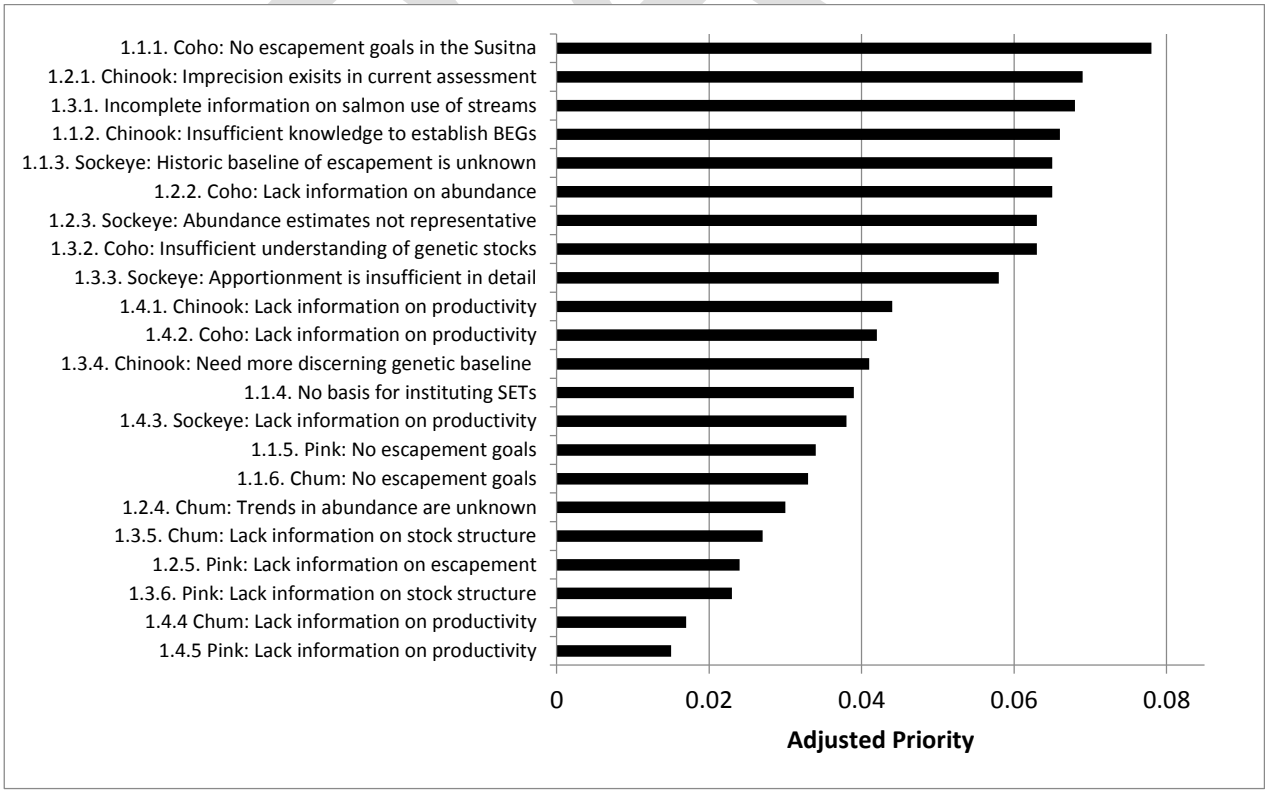

Figure 10. Adjusted priorities for all 22 issues under Goal 1 Salmon Status.

Goal 2 Issues by Objective

A total of 13 issues were described for Objectives 2.1 through 2.4. The workgroup decided to combine issues under Objective 2.5 Participation with those under Objective 2.1 Economic and Social Values. Thus, the weight of importance for Objective 2.5 was appropriately re-distributed among the remaining four objectives under Goal 2.

Table 15. ***Issues and example options identified for Objective 2.1 Economic and Social Values.***

Level 3: Objective 2.1 Economic and Social Values Assess the economic and social values associated with sport, commercial and personal use fisheries.
Level 4: Issues with Example Options
2.1.1. Information on economic and social values is: a) not current, particularly in regard to changing values in relation to changing trends in fishing and management strategies; b) not well understood by policy makers and the public; and, c) not well integrated into decision-making affecting salmon in UCI. *Suggested options:* *a. Conduct (repeat) the 2007 ADFG economic study, with a focus on UCI salmon.* *b. Strengthen advice to the BOF on the socioeconomic impact of management strategies and regulations on stakeholders of UCI salmon fisheries.* *c. Assess the economic and social impacts of the proposed ballot initiative to eliminate set net salmon fishing in UCI.*
2.1.2. Need to obtain information on additional variables relating to fishing participation to: a) assess the accuracy of current data-collection efforts, b) explain factors influencing fishing, and c) project changes in participation trends in order to improve the socioeconomic body of knowledge for decision-making affecting salmon in UCI. *Suggested options:* *a. Expand independent assessment of bias and precision (e.g., onsite surveys) of the SWHS, including a preference survey.* *b. Maintain/improve estimates of variables associated with participation by fishery.*

Under Objective 2.1, Economic and Social Values, many pointed out that benefits derived from fishing are influenced by the Alaska Board of Fisheries, who are presented with economic and social data for their consideration of alternative management proposals, particularly proposals affecting allocation among users. Thus, it is imperative that data on economic and social values be up to date, understandable and clearly integrated into decisions affecting salmon in UCI (Issue 2.1.1). All rated information on economic and social values as the strongest importance (mean score of 6.9).

Two aspects of fishing participation were discussed (Issue 2.1.2) and rated of moderate importance (mean score of 3.3). The first aspect is the use of participation data to provide estimates of sport harvest and effort, as accomplished by ADFG's Statewide Harvest Survey (SWHS), conducted through mail-outs. While one person maintained that accuracy of the SWHS has already been verified, another pointed out that there is a lag time in the availability of data. Onsite surveys conducted inseason would not only continue to check the accuracy of the mail-out survey, but also provide more timely data. The second aspect concerned "holes" in the current collection of participation data. While numbers of participants in commercial fisheries are collected by the Alaska Commercial Fisheries Entry Commission, and several types of data

about participants in sport fisheries are collected by the SWHS, nonetheless additional variables associated with fishing participation could be collected that would be helpful in explaining factors that influence fishing (e.g., social and cultural constraints), estimating trips and expenditures, and projecting changes in participation rates. These additional variables would add to the socioeconomic body of knowledge relating to salmon fishing in UCI. For example, one person was curious about the relationship of income to participation in multiple fisheries (e.g., sport, personal use, and commercial). Another aspect of participation not well understood are people who purchase salmon from commercial fishers – are not buyers participants? What are their characteristics? And, what are the estimated benefits that they accrue from fishing?

Table 16. Issues and example options identified for Objective 2.2 Management Strategies and Tools.

Level 3: Objective 2.2 Management Strategies and Tools Evaluate the effectiveness of existing and alternative management strategies and tools.
Level 4: Issues with Example Options
2.2.1. Need to develop stock specific management strategies in mixed stock fisheries to avoid over-harvesting weak stocks and under-harvesting strong stocks. *Suggested options:* *a. Conduct acoustic studies to gain a better understanding of migratory routes and timing for major species/stocks.* *b. Collect additional information on gear/area/timing options on harvest by species.* *c. Evaluate alternative commercial management strategies and tools that more-effectively focus harvest on target stocks and species (e.g. time and area fishing patterns).*
2.2.2. In-season projections of timing and run strength for both marine and freshwater fisheries are inadequate to guide management actions to focus harvest on abundant stocks while also meeting escapement goals. *Suggested options:* *a. Improve/increase test fishing for stock specific projections.* *b. Conduct genetic studies for stock identification beyond sockeye.* *c. Improve precision of commercial catch allocations by stock.*
2.2.3. A lack of management objectives for species and stocks other than major sockeye and Chinook stocks limits management effectiveness for accessing harvestable surpluses while also ensuring sustainable escapement levels of all run components. *Suggested options:* *a. Establish management objectives for additional stocks of Chinook, sockeye and coho.*
2.2.4. Preseason forecasting accuracy is insufficient for effective management of salmon in UCI; and, there is a lack of preseason forecasts for some important species including coho salmon. *Suggested options:* *a. Improve precision of commercial catch allocations by stock by reducing stock assessment measurement error.* *b. Conduct genetic studies for stock identification beyond sockeye in order to provide information needed to improve stock-specific forecasting accuracy.*

Under Objective 2.2 Management Strategies and Tools, the concern rated of strongest importance (mean score of 7.5) was the need to establish effective mixed stock management strategies (Issue 2.2.1).Stock-specific management strategies are important for optimizing benefits while preserving sustainability of all stocks. While habitat is essential and its importance

should not be overlooked, the development of effective fishery management strategies and tools may be a more pressing need where habitat is in relatively good shape.

To address Issue 2.2.1, several options were discussed. A key to devising an effective mixed stock management strategy is to know what fish are being caught. Understanding migratory pathways and timing will help focus fisheries on target stocks. Advances in technology provide more effective methods for stock identification than historical analyses, such as scale pattern analysis which identified time and area patterns. Newer technology includes acoustic studies. Options to evaluate management tools used in efforts to manage mixed stocks were highly favored by the group. For example, new commercial fishing regulations have mandated the use of shallower-depth gillnets with the purpose of reducing catch of Chinook salmon while increasing catch of sockeye salmon. This new regulation needs to be evaluated as to whether it is achieving its intended effect. In another example, recent time and area restrictions have been imposed on drift gillnet fisheries for the purpose of providing a conservation corridor for northern-bound salmon. These new restrictions need to be evaluated as to whether they are achieving their intended effects.

The need for inseason information on run timing and strength to guide management actions (Issue 2.2.2) was rated strongly important (mean score of 6.3) because effective mixed stock management strategies rely on stock-specific data in order to focus harvest on abundant stocks while meeting escapement goals. Variables such as migration patterns may exhibit year to year differences, so timely inseason information is critical to achieving optimal benefits from sustainable fisheries.

A lack of management objectives for stocks other than major sockeye and Chinook runs (e.g., northern stocks of coho and minor runs of sockeye and Chinook), as well as for several species of salmon (chum and pink) (Issue 2.2.3) was rated strongly important (mean score of 5.9) because management effort is driven by objectives. If there are no established objectives, the concern is that these other stocks and species will be subject to less management and research attention.

Limitations on the accuracy of preseason forecasts in run size was identified as a management constraint (Issue 2.2.4). This issue was moderately important (mean score of 4.3) in recognition of the priority placed on in season information for effective implementation of mixed stock management strategies.

Table 17. Issues and example options identified for Objective 2.3 Harvest.

Level 3: Objective 2.3 Harvest Estimate amount/composition of harvest for each fishery.
Level 4: Issues with Example Options
2.3.1. Information on age, sex and length (ASL) in the sport harvest of Chinook salmon is not sufficient to evaluate run composition and fishery effects on different run components. *Suggested options:* *a. Expand angler surveys to collect additional information on ASL in the Chinook sport harvest.*
2.3.2. Information on freshwater catch & release mortality of Chinook, coho and sockeye salmon in the Susitna is insufficient to accurately estimate total returns, impacts of fishing, and the effectiveness of management measures intended to reduce this impact where needed. *Suggested options:* *a. Conduct tagging studies to estimate freshwater catch & release mortality in key fisheries where information is lacking.*
2.3.3. Information on the incidental effects of commercial fisheries due to drop out mortality and sublethal effects in net-marked Chinook, coho and sockeye salmon of the Susitna is insufficient to accurately estimate returns, impacts of fishing, and the effectiveness of management measures intended to reduce this impact where needed. *Suggested options:* *a. Conduct tagging studies to estimate drop out mortality and sublethal effects of net marked fish.*

Under Objective 2.3 Harvest, the group agreed that harvest estimates by user group are critical to fishery management. Currently, excellent fish harvest reporting systems provide sufficiently accurate and timely estimates for effective fishery management. For example, commercial fish harvest is reported by daily fish tickets; sport harvest is reported post season by ADFG's Statewide Harvest Survey (SWHS), conducted through mail-outs. However, the group highlighted the utility of additional information on several harvest-related issues. T

Strong importance (mean score of 5.1) was placed on the need to better understand age, sex and length (ASL) in the Susitna sport harvest of Chinook (Issue 2.3.1) for run reconstruction to document changes in composition over time. While it is difficult to separate out impacts of fishing selectivity on a fish stock from impacts of environmental changes, nonetheless, studies conducted in other areas have found that management tactics (e.g., mesh size in gillnets) can affect traits related to fish size. That is, size-selective fishing can lead to a decrease in the average size in salmon. Similar studies have not been conducted in the Susitna, however trends in declining sizes of Chinook salmon have been observed. One person noted that while few Chinook originating in the Susitna are harvested in the UCI commercial fishery, commercial harvest of coho and sockeye salmon bound for waters of the Mat-Su Borough is substantially greater. Additional collection of ASL data through angler creel surveys was suggested to address Issue 2.3.1, as well as issues found under Goal 1, Salmon Status (Issues 1.4.1, 1.4.2 and 1.4.3).

Questions arose about the accuracy of catch and release mortality estimates for highly active inriver salmon fisheries (Issue 2.3.2).Some catch and release mortality estimates are available for sport fisheries in other areas, but their applicability to sport fishing for salmon in the Susitna is unclear. Little information is available about the sublethal effects of catch and release fish. This issue was rated moderately important (mean score of 4.1). There is almost no information on the

magnitude of unaccounted mortality of fish that drop out of commercial nets or the fate of net-marked fish (Issue 2.3.3) which escape nets but experience delayed mortality. Impacts from injured drop outs may include reduced viability on the spawning grounds. This issue was rated moderately important (mean score of 3.5).

Table 18. Issues and options identified for Objective 2.4 Hatchery Enhancement.

Level 3: Objective 2.4 Hatchery Enhancement Provide information on hatchery enhancement effectiveness and opportunities consistent with salmon sustainability and optimum use.
Level 4: Issues with Example Options
2.4.1. There is an inaccurate perception by policy-makers and the public about the effectiveness and limitations of salmon hatcheries for supplementing salmon in the Mat-Su region. *Suggested options:* *a. Synthesize information on salmon hatchery effectiveness and risks based on evaluations of comparable programs in other areas.* *b. Document evaluations in technical and non-technical forms to serve a variety of audiences.*
2.4.2. There is a lack of knowledge about where in the Mat-Su region hatcheries might be effective for providing additional fishing opportunities or otherwise addressing declines in wild stocks. *Suggested options:* *a. Complete an assessment of potential opportunities for additional hatchery production of Chinook, coho or sockeye in northern Cook Inlet for fishery harvest or conservation based on an evaluation of benefits, costs and risks.*
2.4.3. Need to quantify current hatchery contributions to the harvest of Chinook in order to assess the benefits and cost-effectiveness of existing programs. *Suggested options:* *a. Conduct creel survey sampling programs to estimate wild/hatchery harvest.*
2.4.4. Need a better understanding of wild/hatchery salmon interactions in spawning escapements in order to more clearly weight potentially undesirable impacts of hatchery production. *Suggested options:* *a. Quantify percent of hatchery origin spawners on wild spawning grounds.* *b. Estimate the relative productivity of hatchery and wild fish.*

Under Objective 2.4 Hatchery Enhancement, the group noted the limited use of hatchery enhancement in the Mat-Su region. However, a concern of strong importance (mean score of 6.0) was that policy-makers and the public have an incomplete understanding about the effectiveness and limitations of salmon hatcheries, which has led to misperceptions regarding the value of hatchery investments (Issue 2.4.1).Policy-makers and the public need information about the estimated costs, benefits and risks of supplemental hatchery production for Susitna salmon. For example, building more hatcheries won't solve problems associated with complex (mixed stock and mixed species) fisheries. Complex fisheries, as are found in UCI, create management challenges from differences in salmon productivity - these differences are not resolved by hatchery production.

There may be situations in the Mat-Su region where hatchery enhancement can be an appropriate and effective tool in producing salmon to support fisheries or address declines. Currently, there is a lack of knowledge about where in the Mat-Su region hatchery enhancement might be effective in providing additional salmon (Issue 2.4.2). To be successful, the hatchery

enhancement tool must be matched to the environment. For example, hatchery production should not be regarded as a replacement for declining habitat. The issue was rated of moderate importance (mean score of 4.8)

Questions arose about hatchery contributions to the Chinook harvest (Issue 2.4.3), resulting from funds recently directed by the legislature for Chinook production. There is a need to assess the benefits and cost-effectiveness of this kind of hatchery enhancement program. The issue was rated of moderate importance (mean score of 3.3)

The need for a better understanding of wild/hatchery salmon interactions in the Susitna (Issue 2.4.4) was rated of low importance (mean score of 2.7) because significant research on hatchery and wild stock interactions are underway in Southeast Alaska. Upon completion and peer review, the results of this research can be expected to address many hatchery-related questions in other parts of Alaska, including the Susitna. With this in mind, several of the group advised, "Information is out there and coming in, we just need to wait for it."

Synthesis of all 13 Issues Under Goal 2

Synthesis of adjusted priorities for all 13 issues under Goal 2 resulted in a distribution of importance, where 2.1.1 lack of updated economic and social information is the highest ranked issue. Other important issues concern 2.2.1 need for stock-specific strategies in mixed stock fisheries, 2.2.2 insufficient information for preseason projections, 2.2.3 lack of management objectives for smaller stocks and 2.3.1 need for additional collection of ASL in the sport harvest of Chinook. Lowest ranked issues concern 2.4.4 unknown effects of wild/hatchery spawning interactions and 2.4.3 unknown contribution of hatchery Chinook to the total return.

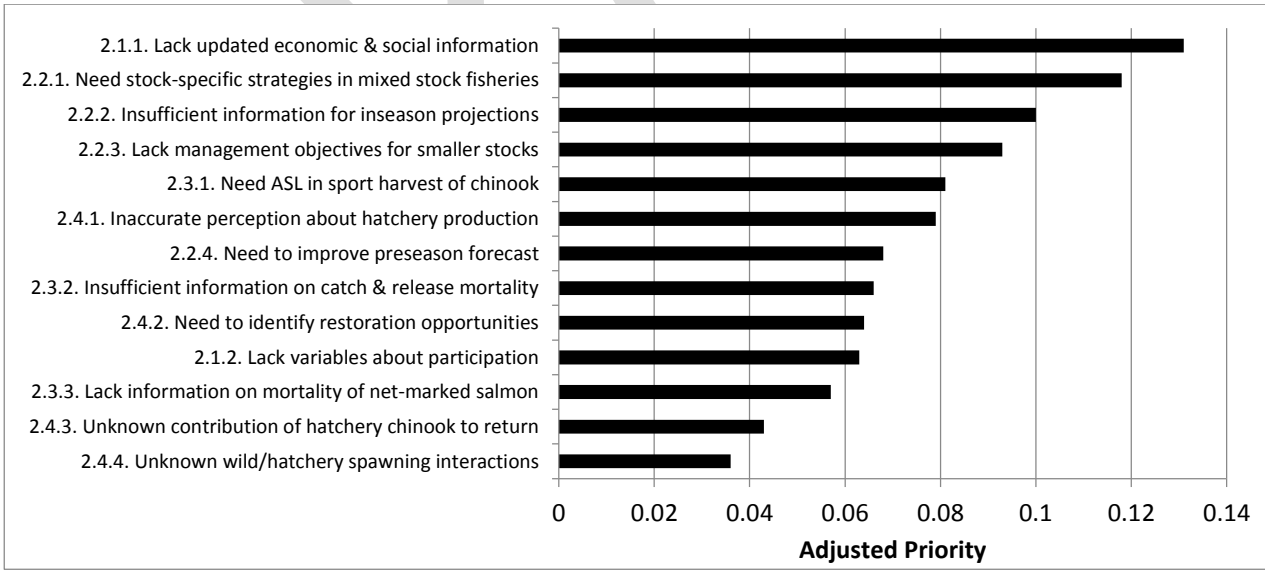

Figure 11. Adjusted priorities for all 13 issues under Goal 2 Salmon Fisheries.

Goal 3 Issues by Objective

A total of 20 issues were described for Objectives 3.1 - 3.5, ranging from one to seven issues per objective. Several issues can be addressed through changes in protocols, policies or planning.

Table 19. Issues and example options identified for Objective 3.1 Ecological Interactions.

Level 3: Objective 3.1 Ecological Interactions Evaluate interactions and impacts of animal and plant species on salmon production and trends.
Level 4: Issues with Example Options
3.1.1. Need to monitor and evaluate the incidence of invasive aquatic species in the Susitna to guide implementation of effective remediation strategies. *Suggested options:* *a. Develop invasive species monitoring and evaluation protocols.* *b. Implement systematic invasive species monitoring and evaluation program.*
3.1.2. The feasibility and benefits of controlling pike to improve salmon production in Alexander Creek and elsewhere in the Susitna drainage are unclear. *Suggested options:* *a. Conduct a pike distribution assessment (e.g., environmental DNA).* *b. Evaluate alternative control and suppression methods.*
3.1.3. The impacts of the invasive aquatic plant, Elodea, on salmon production and effective alternatives for control in the Susitna are unclear. *Suggested options:* *a. Continue Elodea monitoring in vulnerable lakes.* *b. Evaluate Elodea eradication methods for efficacy.* *c. Conduct prevention and education outreach efforts.*
3.1.4. The significance of parasites and disease to sockeye production in Shell Lake and elsewhere is unclear. *Suggested options:* *a. Assess PKD presence and other parasite/disease in other sockeye lakes.* *b. Evaluate success of enhancement in countering related sockeye declines in Shell Lake.* *c. Evaluate the importance of temperature in the incidence of disease.*
3.1.5. Beaver dams may impede adult salmon passage in the Susitna. *Suggested options:* *a. Evaluate where and when beaver dams negatively impact salmon.* *b. Evaluate effectiveness of remediation alternatives (breaching, trapping, etc.)*
3.1.6. The ecological significance of varying levels of Marine Derived Nutrients (MDN) related to salmon escapement in the Susitna is poorly understood. *Suggested options:* *a. Investigate MDN effects of sockeye, pink and chum escapement.*
3.1.7. There is a lack of information on marine mammal predation on salmon in UCI. *Suggested options:* *a. Describe marine mammal distribution and diet in UCI.*

Under Objective 3.1 Ecological Interaction, a variety of biological factors affecting salmon abundance and productivity were discussed. Three issues about invasive aquatic species were rated strongly important. Most critical (mean score of 7.5) was the need to monitor and evaluate the incidence, impacts and risk of invasive aquatic species in the Susitna to guide prevention and remediation strategies (Issue 3.1.1) because once invasive species are established, they are

difficult to control. One person thought that assistance may come from Alaska statute that instructs the establishing of a state coordinator for invasive species. The group highlighted the importance of a comprehensive plan for addressing invasive aquatic species in the Susitna.

Biologists have difficulty in controlling invasive pike in connected water systems of the Susitna. Salmon abundance has declined in historically-productive lakes coincident with pike colonization. An experimental control program is being implemented in Alexander Creek. Preliminary results suggest that significant numbers of pike can be removed and that salmon production correspondingly improves. However, control efforts are costly and effects are expected to be temporary unless removal efforts are sustained. In addition, the scale of pike invasion in lower elevation Mat-Su waters is such that costs of a widespread control effort would be daunting even if it were feasible. Finally, interactions of pike predation and habitat changes are not clearly understood. Thus, the feasibility and benefits of attempting to control pike to improve salmon production are unclear (Issue 3.1.2). The issue was rated strongly important (mean score of 6.4).

Another invasive species, the aquatic plant, Elodea, is extremely aggressive and contributes to changes in primary production patterns (Issue 3.1.3). Decreased oxygen levels have been documented. Additionally, Elodea is believed to provide preferred habitat for pike, enhancing that predator's effectiveness. While only one lake in the Mat-Su has been found to contain Elodea, the plant has established elsewhere in the state, including Anchorage, Cordova and Kenai areas. Questions arose about effective alternatives for control of Elodea and potential impacts on salmon. The best prospects for long term control of Elodea come when the problem is addressed in the early stages before the scale of invasion overtakes the potential remedies. The issue was rated strongly important (mean score of 5.7).

Concerns about disease in Shell Lake are based on the analysis of samples taken from dead sockeye which tested positive for the only documented case of Proliferative Kidney Disease (PKD) in the Mat-Su Borough. There may be additional instances of this highly infectious parasitic disease that are unknown (Issue 3.1.4). Diseases are endemic in wild fish and outbreaks can cause significant mortality. Outbreaks are often triggered by environmental stressors such as warm temperatures, low flows and fish crowding. Additional information is needed on salmon diseases in the wild to understand significance and implications of observed incidences. One person commented that it is better to inventory the extent of the concern and address its occurrence sooner rather than later, as prevention and control measures in the wild are limited. The issue was rated moderately important (mean score of 3.4).

The group acknowledged that beaver dam impacts on salmon are complex: their impacts depend upon the location of the dam and species of salmon. Beaver dams can either benefit salmon by creating favorable habitats for rearing salmon, particularly for coho juveniles; or, impede salmon by blocking upstream adult passage, particularly for adult sockeye in small streams (Issue 3.1.5). The issue of beaver dams impeding adult salmon passage was deemed of moderate importance (mean score of 3.2) because beavers have always been present and their activity is integral to habitat function and processes in the natural ecosystem. Questions were raised about the short and long term efficacy and cost-benefits of dam removal efforts.

While the group agreed that there is a fair amount of knowledge regarding the contributions of Marine Derived Nutrients (MDN) delivered by salmon to watershed and terrestrial productivity for other areas, there is difficulty in translating that body of information to specific guidance for management of salmon escapement in the Susitna (Issue 3.1.6). Questions concerning the ecological significance of varying levels of MDN vectored by salmon spawning in the Susitna received scores of relatively low importance (mean score of 2.0).

The lowest rated (mean score of 1.3) issue concerned a lack of information on marine mammal predation of salmon in UCI (Issue 3.1.7). The group viewed marine mammals as something else potentially eating salmon. However, marine mammals are native and have diverse food sources available thus likely pose a low risk to Susitna salmon. The importance of salmon as food for listed Beluga was also noted but Beluga population dynamics are being addressed by other initiatives.

Table 20. Issues and example options identified for Objective 3.2 Human Factors.

Level 3: Objective 3.2 Human Factors Evaluate status and effects of human development and activities on salmon production and trends.
Level 4: Issues with Example Options
3.2.1. Information on impacts to salmon from land use development, and guidelines for avoiding impacts, is needed for the development of policy requiring consideration of impacts to salmon in Mat-Su Borough land use plans. *Suggested options:* *a. Identify appropriate criteria for riparian buffers in different areas.* *b. Identify appropriate criteria for septic system restrictions to maintain water quality.*
3.2.2. Culverts block fish passage into otherwise favorable salmon habitat in the Susitna. *Suggested options:* *a. Identify and prioritize problem areas for culvert replacement (borough and state roads and the railroad) based on the quantity and quality of affected salmon habitat.*
3.2.3. The extent of unregulated development in floodplains of the Mat-Su Borough is uncertain and impacts to salmon habitat are unknown. *Suggested options:* *a. Document the extent of unregulated development in floodplains.* *b. Identify critical areas at risk of further development.*
3.2.4. The amount and distribution of impervious surfaces mapped in 2008 is out of date, thus is inadequate to assess recent trends and effectiveness of stormwater runoff controls for avoiding detrimental impacts to salmon habitat quality. *Suggested options:* *a. Update the 2008 map of impervious surfaces.* *b. Map stormwater outfalls (this was not on the 2008 map).* *c. Monitor water quality of stormwater outfalls.*
3.2.5. Existing information on shoreline degradation at sport fish access sites is inadequate to assess the magnitude of this potential problem, its significance to salmon habitat, and ensure effective remediation. *Suggested options:* *a. Assess the magnitude of shoreline and riparian habitat degradation at angler access sites.*

Under Objective 3.2 Human Factors, the strongest rated issue (mean score of 6.2) concerned the need to obtain information for avoiding impacts to salmon from land use development that can inform effective Mat-Su Borough land use plans and guidelines (Issue 3.2.1). Of particular value would be information that translates into criteria for various activities such as riparian buffers or septic systems restrictions. While it is often all too easy to identify blanket criteria, the most effective criteria include considerations for the specifics on any given case so that ineffective restrictions are not implemented unnecessarily.

Information on culverts that potentially block salmon movement (Issue 3.2.2) continues to command attention and was thus rated strongly important (mean score of 5.8).While culverts do not impact salmon in the major portion of the Mat-Su region which is roadless, poorly designed and constructed culverts have been identified in developed areas. Substantial efforts have been undertaken to address culverts that impede salmon passage. Additional information on the locations of problem culverts (especially those located on borough and state-owned roads as well as the railroad) and prioritization as to degree of salmon habitat value, would ensure cost-effective remediation.

An issue came to light concerning unregulated development in the floodplains of the Mat-Su Borough and unknown impacts to salmon habitat (Issue 3.2.3). Floodplain conditions and connections to rivers and streams are critical to processes and function that shape salmon habitat. There are significant violations – information is needed to document the location and extent of unregulated development in the floodplain and how much salmon habitat has been affected. Obtaining this knowledge is the first step towards improving protection of salmon habitat in the floodplain. The group assigned a moderate rating of importance to this issue (mean score of 4.7).

The amount and distribution of impervious surfaces mapped in 2008 is out of date, thus is inadequate to assess recent trends and effectiveness of stormwater runoff controls for avoiding detrimental impacts to salmon habitat quality (Issue 3.2.4). Hard surface, including roads and parking lots, can substantially increase stormwater runoff in developed areas with concomitant effects on stream hydrology, erosion and a variety of other water quality features important to salmon. The group assigned a moderate rating of importance to this issue (mean score of 4.6).

Shoreline damage at sport fish access points caused by anglers and off-road vehicles trampling vegetation and eroding the bank, thereby increasing sedimentation, may negatively impact salmon habitat on a local scale (Issue 3.2.5). Additional information on the scale and location of these impacts to assess the magnitude and significance of the problem would be useful for guiding protection, restoration and education activities. However, angler access points are confined in area; most of the Mat-Su Basin is not affected by this issue, so the mean rating of this issue was of moderate importance (mean score of 3.8). The issue needs to be brought to the public's attention because there are improved ways of accessing the water without destroying the shoreline. Upon assessing the problem, restoration along with public outreach can be used to remedy habitat degradation.

Table 21. Issues and example options identified for Objective 3.3 Aquatic Habitat Conditions.

Level 3: Objective 3.3 Aquatic Habitat Conditions Characterize quantity and quality of freshwater and estuarine habitats which affect salmon production.
Level 4: Issues with Example Options
3.3.1. Water quality baselines in the Susitna are not adequate to assess patterns and trends which may impact salmon. *Suggested options:* *a. Identify index watersheds and sites for long-term water quality monitoring.* *b. Initiate broad scale temperature monitoring.*
3.3.2. Water quantity baselines in the Susitna are not adequate to assess patterns and trends which may impact salmon. *Suggested options:* *a. Install river gauge stations to monitor hydrology.* *b. Collect data to support water reservation proposals.*
3.3.3. There is a lack of information (through space and time) on changing habitat conditions in the Susitna (habitat types, channel morphology, bank stability, substrates, rising water temperature, etc.) in relation to salmon production. *Suggested options:* *a. Describe important salmon habitat by life stage.* *b. Complete physical habitat surveys of representative areas.* *c. Select index watersheds and sites to monitor over time.* *d. Monitor and evaluate changing habitat conditions in relation to salmon production.*

Basic information on water quality (Issue 3.3.1), water quantity (Issue 3.3.2), and aquatic habitat conditions (Issue 3.3.3) throughout the Mat-Su Borough is incomplete and is needed to evaluate changes over time and impacts of related factors. The quality of the existing information is also quite variable. The need for this information was afforded a relatively strong priority by the group (mean scores ranging from 5.9 to 6.3).

Table 22. Issues and example options identified for Objective 3.4 Marine Ecology.

Level 3: Objective 3.4 Marine Ecology Evaluate ecology and habitat conditions and influences of the near- and offshore marine environment in Upper Cook Inlet on salmon production and trends.
Level 4: Issues with Example Options
3.4.1. Information on the distribution of juvenile salmon in estuarine and nearshore marine waters of UCI, and use of these areas, is not adequate to assess their importance to salmon ecology and production. *Suggested options:* *a. Identify juvenile salmon habitat use and availability in estuary and nearshore marine waters of UCI.* *b. Estimate condition, growth and survival of salmon in estuary/nearshore habitat.*

The sole issue identified by the group for Objective 3.4 Marine Ecology was a need for information on the distribution and use by juvenile salmon of estuarine and nearshore areas in UCI (Issue 3.4.1).While understanding of juvenile salmon use of these areas in UCI is currently inadequate to assess significance of habitat and environmental changes, direct application of this information to salmon conservation and management is unclear.

Table 23. Issues and example options identified for Objective 3.5 Landscape and Watershed.

Level 3: Objective 3.5 Landscape and Watershed **(0.049)**Evaluate landscape, watershed, wetland, riparian and hydrological factors which affect freshwater salmon habitat conditions.
Level 4: Issues with Example Options
3.5.1. Loss of wetland salmon habitat to filling and development in the Mat-Su Borough has not been quantified, nor assessed in relation to salmon production. *Suggested options:* *a. Develop an estimate of wetland losses from 2000 to present and current reference conditions based on aerial photogrammetry and/or index sites.*
3.5.2. Inaccurate stream maps may limit the ability to assess and protect important salmon habitats. *Suggested options:* *a. Conduct additional mapping studies.*
3.5.3. A lack of understanding of groundwater and surface water exchanges in the Susitna River limits the ability to assess the significance of these processes to salmon production and to identify critical areas in need of protection. *Suggested options:* *a. Continue groundwater monitoring initiated by AEA for the Susitna Watana project.*
3.5.4. An incomplete understanding of sediment processes in the Susitna limits the ability to assess the significance of these processes to salmon production, and impacts and risks of land use and development. *Suggested options:* *a. Study sediment processes near the three river confluences.*

Under Objective 3.5 Landscape and Watershed, the group agreed that landscape and watershed conditions which affect salmon habitat in the Mat-Su region, with few localized exceptions, are in excellent shape. Four issues were identified as needing attention, including loss of wetland habitat to filling and development (Issue 3.5.1). Quantification of changes in wetlands was rated strongly important (mean score of 5.2). Wetlands were inventoried in 2000 but current information is needed to evaluate changes and identify problem areas.

Inaccurate mapping of streams (Issue 3.5.2) was deemed an issue of moderate importance (mean score of 4.5).Accurate maps of streams are a foundational piece for habitat assessment activities. Changes in stream course following high water events are a continuing challenge to maintaining accurate maps in dynamic systems like the Susitna. The availability of advanced technologies such as lidar has vastly improved the capability to develop accurate maps.

Lack of understanding of groundwater and surfaces exchanges in the Susitna River (Issue 3.5.3) was rated moderately important (mean score of 4.4). Upwelling areas in rivers and streams have been found to be critically important spawning and rearing areas for salmon. Chum salmon in particular are closely linked with these upwelling areas for spawning. Information on the quantity, quality and dynamics of these critical areas is limited.

An incomplete understanding of sediment processes (Issue 3.5.4) was rated moderately important (mean score of 3.7). Sediment processes are important to the quantity, quality and distribution of productive salmon habitats, particularly in glacial systems like the Susitna. Processes may involve complex interaction between inputs, export, and the rate of water flow.

Sediment processes can also have significant implications to land use, for instance by affecting dynamics of flooding and erosion.

Synthesis of all 20 Issues Under Goal 3

Synthesis of adjusted priorities for all 20 issues under Goal 3 resulted in a distribution of importance, where 3.1.1 need to monitor and evaluate invasive aquatic species is the highest ranked issue. Other important issues concern 3.1.2 presence of pike and 3.1.3 Elodea, 3.2.1 lack of information to consider impacts to salmon in land use development plans and 3.2.2 culverts that block fish passage. Lowest ranked issues concern 3.1.7 lack of information on marine mammal predation of salmon in UCI and 3.1.6 poor understanding of the effects of varying levels of Marine Derived Nutrients on production in the Susitna.

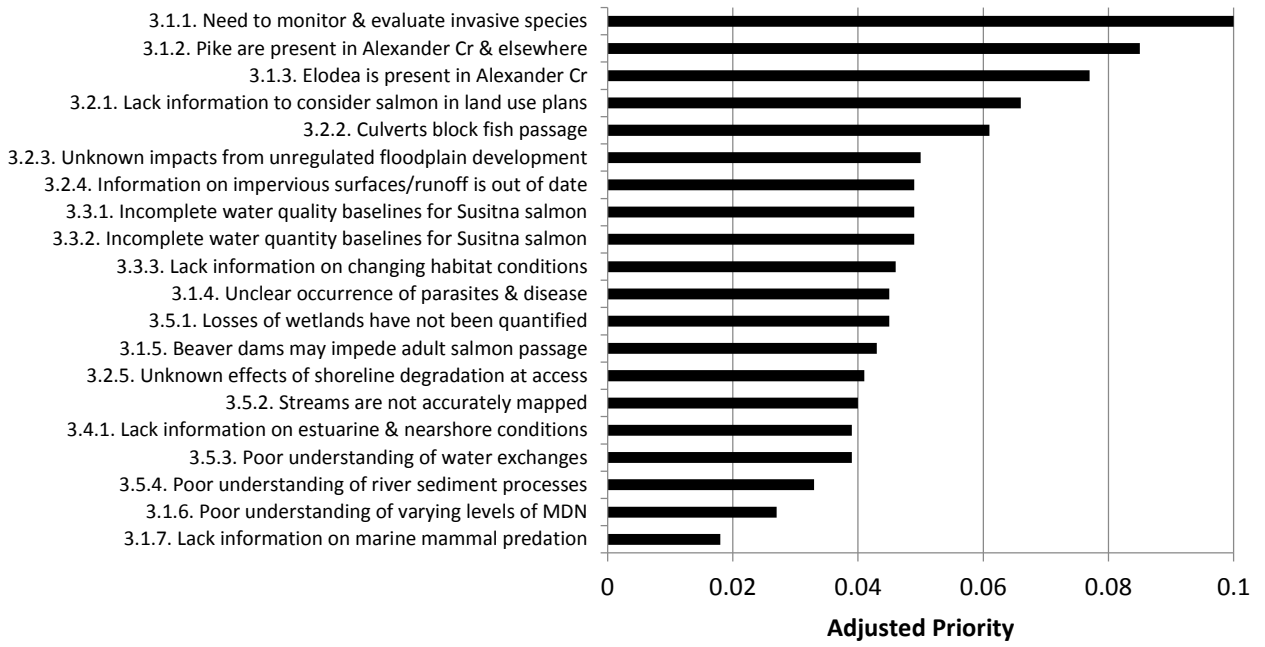

Figure 12. Adjusted priorities for all 20 issues under Goal 3 Salmon Ecosystem.

Synthesis of all 55 Issues

Synthesis of adjusted priorities for all 55 issues resulted in a distribution of ranks derived from the proportional weight of importance of an issue relative to others in its group, as well as from the weight of its parent node – the objective. Ranks for many issues fall into equal or similar blocks. It may be most helpful to view the distribution of ranked issues in terms of three categories: 1) issues highly ranked (black), 2) issues whose ranks fall somewhere in the middle (textured grey), and 3) issues ranked low in priority (grey). Those issues ranking highest include 2.1.1 lack updated economic and social information, 2.2.1 need stock-specific strategies in mixed stock fisheries and 1.1.1 lack of coho escapement goals in the Susitna. Issues ranking lowest include 3.1.7 lack information on marine mammal predation of salmon, and lack information on pink (1.4.5) and chum (1.4.4) productivity.

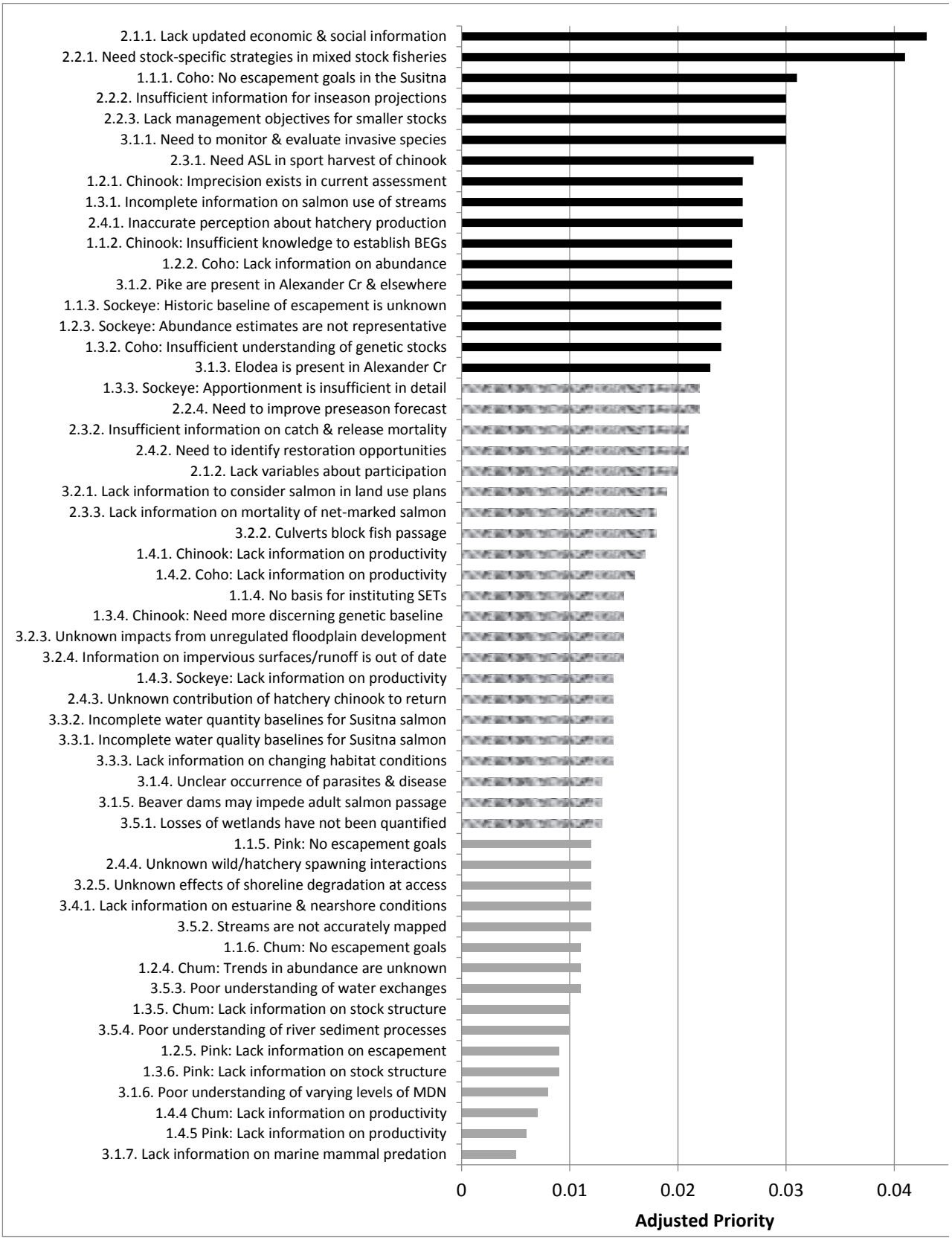

Figure 13. Adjusted priorities for all 55 issues in the Mat-Su Salmon RM&E Plan.

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Glossary

Benefits. Value and satisfaction accrued to humans through their harvest and enjoyment of salmon, as well as value to the riparian habitat to sustain ecosystem functioning.

Evaluation. Systematic and objection synthesis of data and information for the purpose of informing strategic decisions. Example: evaluate the effectiveness of management alternatives for meeting established escapement goals.

Expert judgment. Relevant experience, supported by rational thought and knowledge.

Goal. A long term achievement that contributes to accomplishing a mission that can begin with: protect, manage, maintain, harvest, sustain, provide. An example is, "Protect wild Chinook salmon freshwater habitat to provide for ecosystem diversity." Goals can either be: already mandated in a legal or management framework; established prior to group planning by the funding agency; or, created by stakeholders in a group setting. In prior salmon plans developed by the State, goals have incorporated principles of the Sustainable Salmon Fisheries Policy.

Importance. Meant to convey degree of dominance, one over another. For example, are all objectives of equal importance to achieving the goal? If not, which one is the most important?

Issue. Includes an information need, but is broader in meaning. An impediment to achieving an objective that includes uncertainty, incomplete or a lack of information, political or socioeconomic difficulties. An example is, "Total harvest is uncertain." Stakeholders are vital to identifying issues.

Mission. A responsibility to fulfill. The mission is usually (but not always) a mandate ordered through a legal framework and is not subject to (much) change by the funding agency or stakeholders. An example is, "Sustain a healthy and biologically diverse wild salmon ecosystem in southeast Alaska and the human use of wild salmon in that ecosystem, through salmon research, monitoring, restoration and stewardship."

Monitoring. Systematic and routine collection of information over a period of time, typically for the quantification of status, trends, and effects. Monitor fresh water temperature and flow volume in indicator streams.

Objective. A measurable statement of purpose that can begin with: characterize, describe, identify, estimate, monitor, document. An example is, "Characterize physical parameters of spawning and rearing habitat." Stakeholders are often invited to participate in a group setting in creating objectives.

Option. Includes a strategic action, but is broader in meaning. A course of action or protocol to address and overcome an issue or sub-issue. Examples are conduct coded wire tag projects, radiotelemetry, adopt standards, etc. Stakeholders are vital to identifying options.

Planning. A *repetitive* decision-making activity involving *thinking & social* processes that help to design what is perceived as a *desirable outcome.*

Priority. Also priority score. In AHP, priority is expressed using a positive inverse ratio scale. Priority implies units of measurement.

Problem. The difference between the current condition and the desired condition. An example of a problem: salmon are declining. Problem-solving is an approach taken to describe the desired condition and how to get there. The problem statement is usually the overarching premise for funding.

Rank. The position of an element relative to others in the group, such as top-ranked.

Rating. Classifying importance according to a standard or scale. For example, people rated the importance of Goal 1, "Salmon Status" using the positive inverse ratio scale. The result was a priority score.

Research. Systematic investigation in order to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. Example: identify spawning areas using radiotelemetry.

Scope. Limitations placed on the range of activities or intent; a clear definition of what will or will not be addressed. Example: geographic scope defines the physical boundaries of the research plan.

Stakeholder. Individuals who are either responsible for oversight or are directly affected by decisions.

Strategic. Long term future based on goals. Most strategic plans for salmon have a 3-5 time year horizon.

Sub-issue. Specific categories of the main issue to help direct thinking about options. If the main issue is, "Total harvest is unknown", its sub-issues can be: interception in Area M, unreported subsistence harvest, identification error in the commercial fishery, etc. Stakeholders are vital to identifying sub-issues.

Systematic approach. The whole problem is viewed as a system, whose parts are structured, and the links between the parts identify interactions and influences. Used in solving complex problems.

VII. APPENDIX

Table 24. Participants in the Mat-Su salmon planning workshop, January 21-22, 2015.

	Affiliation	Background	Person	Email	Phone
1	MSB Fish & Wildlife Comm.	Sport /Personal use	Larry Engle	larryengle@gci.net	(907) 745-4132
2	MSB Fish & Wildlife Comm.	Sport /Personal use	Howard Delo	hodelo@mtaonline.net	(907) 892-8796
3	MSB Fish & Wildlife Comm.	Sport /Personal use/Business	Bruce Knowles[1]	bigfish@mtaonline.net	(907) 495-4965
4	ADFG	Sport fish	Tim McKinley	Tim.mckinley@alaska.gov	(907) 267-2124
5	ADFG	Commercial fish	Jack Erickson	Jack.erickson@alaska.gov	(907) 267-2376
6	ADFG	Habitat	Mike Bethe[2]	Mike.bethe@alaska.gov	(907) 861-3202
7	Susitna Valley Advisory Committee (AC)	Sport/Business/Commercial	Mike Wood	mike@susitnarivercoalition.org	(907) 354-5815
8	Mat Valley AC/MSB Fish & Wildlife Comm.	Sport/Business	Jehnifer Ehmann	jehnifer.ehmann@gmail.com	(907) 354-0059
9	Mat-Su Borough (MSB)	Local government	Frankie Barker	frankie.barker@matsugov.us	(907) 746-7439
10	USFWS / Mat-Su Salmon Habitat Partnership	Habitat	Jon Gerken	jon_gerken@fws.gov	(907) 271-1798
11	USFWS	Fisheries	Doug McBride	doug_mcbride@fws.gov	(907) 271-2871
12	NMFS	Marine waters	Did not attend		
13	Cook Inlet Aquaculture	Enhancement & Monitoring	Gary Fandrei	gfandrei@ciaanet.org	(907)283-5761
14	Northern District Setnet Fishery	Commercial fish	Did not attend		
15	Central District Driftnet Fishery-UCI Drift Assoc.	Commercial fish	Did not attend		
16	East side Setnet fishery-Kenai Peninsula Fisherman's Assoc.	Commercial fish	Rob Williams	krvwilliams@gmail.com	(907)398-2719
17	Chickaloon Village Traditional Council	Subsistence	Did not attend		
18	Aquatic Restoration & Research Institute	Private non-profit	Did not attend		
19	The Nature Conservancy	Private non-profit	Jessica Speed	jspeed@tnc.org	(907) 865-5713

[1] *Attended Jan 21 only*

[2] *Attended Jan. 22 only*

Table 25. Support staff at the Mat-Su salmon planning workshop, January 21-22, 2015.

Affiliation	Role	Person	Email	Phone
R2 Resource Consultants	Project Lead	Ray Beamesderfer	rbeamesderfer@r2usa.com	(360) 975-7688
Resource Decision Support	Workshop Lead	Peggy Merritt	pmerritt@ak.net	(907) 457-5911
R2 Resource Consultants	Project Assistance	Kai Steimle	ksteimle@r2usa.com	(360) 244-7070
Northwestern Natural Resource Consultants	Regional Expert	Mac Minard	macminard@mt.net	(406) 439-2059