A COLLABORATIVE APPROACH TO PRIORITIZING FISHERIES RESEARCH AND HARVEST MONITORING: A CASE STUDY OF THE FEDERAL SUBSISTENCE FISHERIES PROGRAM IN ALASKA[1]

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ABSTRACT

In 1990 Congress authorized the federal government to assume responsibility for managing subsistence fisheries over a vast expanse of federal lands in Alaska because the state constitution was out of compliance with Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). Substantive information needs, diverse perspectives and large geographic areas posed initial challenges for the Office of Subsistence Management (OSM), U.S. Fish and Wildlife Service. To ensure strategic use of limited funds, and to enhance communication, OSM initiated a collaborative inter-agency, inter-disciplinary process to identify and prioritize program goals, research objectives and information needs, using the Analytic Hierarchy Process (AHP). A gap analysis was used to assess which information needs should be considered for proposals. Facilitated workshops were convened in 2004-2006 for the Copper River-Prince William Sound, Bristol Bay-Chignik, Kodiak-Aleutians, and southeast areas of Alaska. Benefits from using the AHP for strategic planning included clarification of strategic priorities for fishery research and harvest monitoring, and an improvement in project proposals.

Keywords: subsistence fishery management, Analytic Hierarchy Process, gap analysis

1. Introduction

Alaska natives have relied on fisheries resources for thousands of years for food and trade. Many Alaskans today depend on subsistence fishing as a reliable way to obtain food and preserve cultural traditions. Subsistence fish harvest provides about 225 pounds of food per person annually in rural Alaska (USFWS, 2009). The bulk of this is salmon. In 1980 Congress passed Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA) which was intended to ensure continued access to subsistence resources on federal public lands. This act stipulated that subsistence uses of fish and wildlife by rural residents (native and non-native) of Alaska be given priority over other uses on federal public lands. In 1989, the Alaska Supreme Court ruled that the rural residency preference required by ANILCA violated the Alaska state constitution of "common use", which grants equal access to fish and wildlife to all Alaskans, regardless of where they live. Alaska became out of compliance with federal law. In 1990 the federal government assumed management authority for subsistence use of fish and wildlife on federal public lands. In 1999 federal subsistence management was extended to include navigable waters that have federal nexus – an interest or association to a subsistence resource occurring in waters within or adjacent to federal public lands. Today, the federal government manages subsistence uses on federal public lands and waters in Alaska-about 230 million acres or 60 percent of the land within the state. Many

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fish species important to subsistence users migrate through waters under both state and federal jurisdiction, thus necessitating dual state and federal fisheries management.

Substantive information and communication demands, coupled with challenges posed by dual management of fisheries, prompted creation of the Fisheries Resource Monitoring Program in 2000 (hereafter referred to as Monitoring Program) within the Office of Subsistence Management (OSM), U.S. Fish and Wildlife Service. The Monitoring Program was envisioned as a collaborative inter-agency, inter-disciplinary approach to enhance existing fisheries research, and communicate information needed for subsistence fisheries management on federal public lands.

1.1 Rationale for strategic planning

Support for management of subsistence fisheries is provided by information obtained through research and monitoring projects in watersheds and nearshore marine waters across vast geographic regions in Alaska. Studies on fish stock status, harvest monitoring and traditional ecological knowledge are solicited and funded through the Monitoring Program, which was initially provided with $5 million in 2000, then $6.25 million annually beginning in 2001. Complex life histories of different fish species, multi-faceted harvest and use patterns by season, varying perspectives of subsistence users, and insufficient and uncertain fish abundance and harvest information are examples of issues that contribute to the complexity of sustaining subsistence fisheries on federal public land. In the absence of a formal process to evaluate the problem, the sheer number and complexity of issues confounded the ability of managers to determine the highest priority information needs for federal subsistence management.

To ensure wise use of limited funds, from 2004-2006 OSM initiated a rigorous strategic planning process using the Analytic Hierarchy Process (AHP; Saaty, 1999) to identify and prioritize program goals, research objectives and information needs for subsistence fisheries with nexus to federal public lands in four different geographic areas of Alaska (Figure 1):

1. Copper River/Prince William Sound (defining features include Chugach National Forest, Wrangell-St.Elias National Park and Preserve, and the Gulkana Wild and Scenic River);
2. Bristol Bay/Chignik; (defining features include the Alagnak River component of the Wild and Scenic River System, Alaska Maritime National Wildlife Refuge, Alaska Peninsula National Wildlife Refuge, Aniakchak National Monument and Preserve, Becharof National Wildlife Refuge, Katmai National Preserve, Lake Clark National Park and Preserve, and Togiak National Wildlife Refuge);
3. Kodiak/Aleutian Islands (defining features include all non-navigable waters within and adjacent to the Alaska Maritime National Wildlife Refuge, Kodiak National Wildlife Refuge, Alaska Peninsula National Wildlife Refuge, Becharof National Wildlife Refuge, Katmai National Park, and flowing into Shelikof Strait and Pacific Ocean waters); and,
4. southeast Alaska (defining features include Tongass National Forest, Wrangell-St. Elias National Park and Preserve, and Glacier Bay National Park and Preserve).

The intent of the strategic plans is to clarify requests for proposals and define criteria for strategic priorities over a 3-5 year period. This paper describes these four strategic plans, and compares and contrasts the planning outcomes. The strategic planning process used here, and the information identified in the strategic plans, can be applied to managing other subsistence or indigenous fisheries.

2. Methods

2.1 Approach

Strategic planning occurred over a series of facilitated meetings and consisted of three phases:

1. the development of prioritized goals, objectives and information needs (hereafter referred to as hierarchies) by subsistence fishery unit (see below);
2. public review of the hierarchies through Regional Advisory Councils (Council) and subsequent consideration of Council review by workshop participants in a second meeting; and,
3. recommendations for actions based on an inventory of projects, past and present, that relate to information needs, referred to hereafter as the gap analysis. The southeast group differed by basing recommendations for action on a prioritized list of sockeye salmon stocks, rather than information needs.

From 15 to 18 workshop participants were solicited from professionals associated with management or research of subsistence fisheries in the four geographic areas, as well as representatives of a cross section of perspectives and disciplines from federal, state and village/tribal governments, academia, and Alaska Native associations and corporations, creating four groups. Valuable local perspective was provided by Council representation. The meetings were professionally facilitated and co-chaired by staff from OSM.

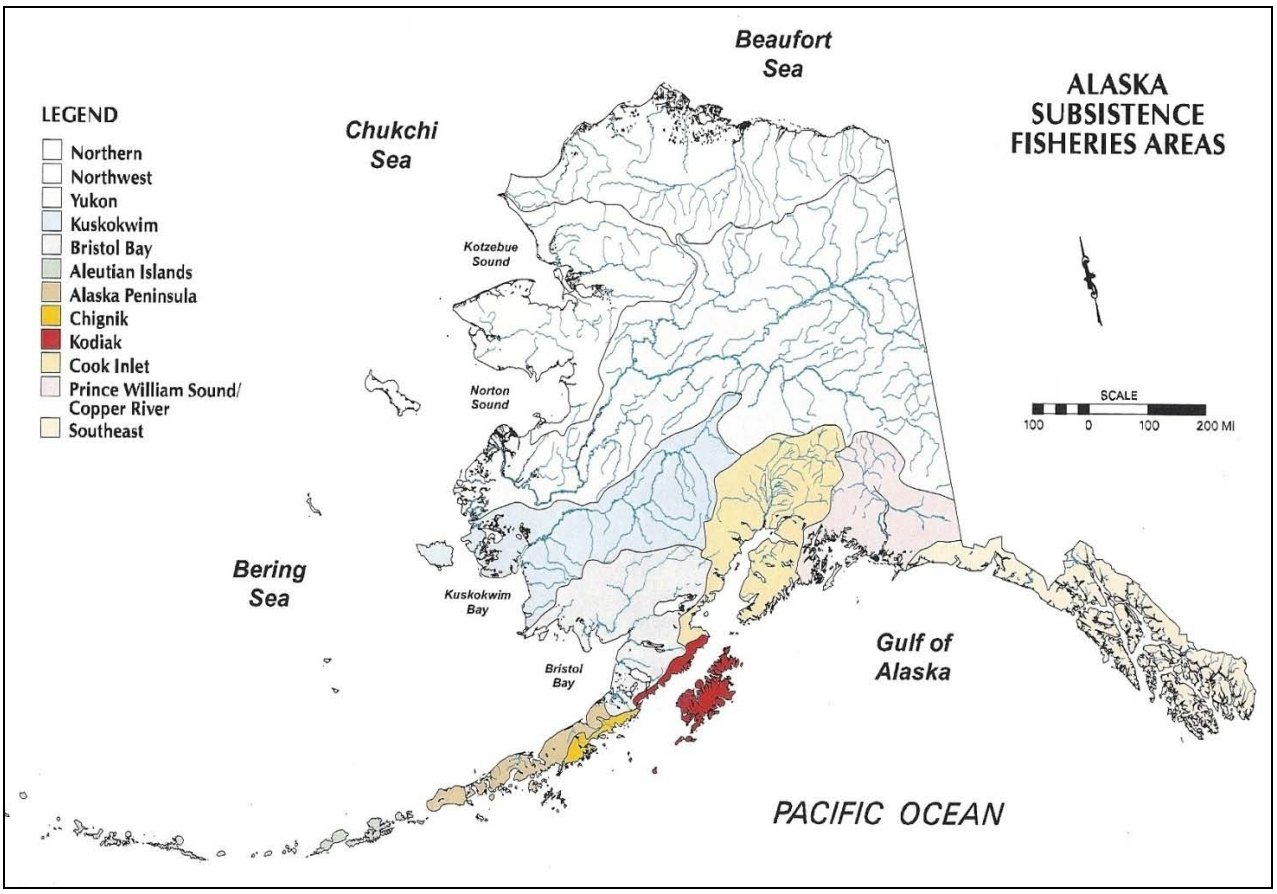

Figure 1. Map of Alaska showing subsistence fisheries areas. Source: Alaska Department of Fish and Game, Subsistence Division.

The AHP was used to structure the plans, and derive the interactions of their parts using expert judgment (Saaty, 1999). The AHP has been used extensively to address planning and prioritization in a variety of disciplines, and has recently been applied to fisheries research and management (Merritt and Criddle, 1993; Merritt, 1995, 2000; Ridgley et al., 1997; Leung et al., 1998; Merritt and Quinn, 2000; Merritt and Skilbred, 2002; SSLMC, 2006; Mat-Su, 2008). The AHP is a tool for facilitating decision-making by structuring the problem into levels comprising a hierarchy. Breaking a complex problem into levels

permits decision makers to focus on smaller sets of decisions, improving their ability to make accurate judgments. Structuring also allows decision makers to think through a problem in a systematic and thorough manner. Decision support software was used interactively to structure the problem, depict the influence of weights, and derive the priority of elements.

2.2 Subsistence fishery units

Workshop participants identified subsistence fishery units (fishery units) as the major functional units for management and regulation of subsistence fisheries with nexus to federal public lands. All groups except from the southeast area defined fishery units by geography, fish species, conservation concerns, method of harvest and users. The southeast group discarded delineation beyond species largely because while subsistence issues can encompass multiple species in a stream/lake system, in reality management is species-driven. Hierarchies were developed for each fishery unit. Salmon were rated as having the highest priority of all species considered, for all areas (Table 1), because salmon are the primary resource for subsistence. In the sake of brevity, all results presented in this paper will pertain to salmon. Full strategic plans can be found at www.r7.fws.gov/asm/strategic.cfm.

Table 1. Subsistence fishery units and their species (in italics) by area, ranked by order of importance.

Copper River/Prince William Sound	**Bristol Bay/Chignik,**	**Kodiak/Aleutian Islands**	**Southeast**
Copper River salmon: *sockeye, Chinook, coho*	Bristol Bay salmon: *Chinook, sockeye, coho*	Salmon: *sockeye, coho pink, Chinook, chum*	*sockeye salmon*
Copper River freshwater species: *burbot, lake trout, Arctic grayling, whitefish, Dolly Varden*	Chignik salmon: *sockeye, coho*	Non-salmon: *Dolly Varden/Arctic char,rainbow/steelhead*	*steelhead*
Prince William Sound/Copper River Delta salmon: *sockeye, coho, chum, pink*	Bristol Bay/Chignik freshwater species: *Arctic grayling, whitefish, Dolly Varden, rainbow trout, smelt, northern pike*		*eulachon*
Copper River: *rainbow/steelhead*			
Copper River: *eulachon*			
Prince William Sound/Copper River Delta freshwater species: *cutthroat trout, Dolly Varden, whitefish*			

2.3 Structure of the hierarchies

A top-down structuring approach was used in the planning process, whereby the mission forms the top of the hierarchy and goals form the second level. The mission and goals of the Monitoring Program were provided by OSM staff prior to the planning meetings. The mission of the Monitoring Program is to:

- Identify and provide information needed to sustain subsistence fisheries on federal public lands, for rural Alaskans, through a multidisciplinary, collaborative program.

Three goals involve the collection and synthesis of information to provide for subsistence uses and form the basis of the Monitoring Program:

1. Assess fish populations,
2. Assess and monitor subsistence fish harvest, and
3. Develop effective management strategies.

Workshop participants were encouraged to clarify goal statements to ensure that each are conceptually representative of their geographic area. After providing guidance for the mission and goals, OSM staff asked workshop participants to identify objectives for each goal. Objectives are measurable statements of purpose, and as intermediary steps, form the third level of the hierarchy. For each objective, participants then identified information needs. Information needs are specific issues, impediments to overcome, data gaps or uncertainties, and form the bottom level of the hierarchy. To facilitate discussion and the development of information needs within objectives, participants formed small workgroups; their recommendations were then presented to the entire group for further comment and refinement.

Elements of the hierarchies were considered in the context of ANILCA, and also guidelines approved by the Federal Subsistence Board, which acknowledge that other agencies take the lead in certain areas of study. Accordingly, the workgroup considered, but did not specifically include, information needs that had little relevance to management of subsistence fisheries on or associated with federal public lands. In addition, information on artificial propagation and enhancement of salmon, contaminant evaluation and monitoring, or habitat protection, restoration and enhancement were not included in the strategic plans.

Structuring of goals, objectives and information needs were completed for each fishery unit in a sequential order, beginning with the most important. The hierarchy developed first was subsequently used as a template from which to launch development of hierarchies for remaining fishery units.

2.4 Establishing criteria for judging importance

Each group was asked, "What makes one element more or less important than another?" Accordingly, groups developed criteria for judging importance. There was considerable discussion about what each criterion represented, which helped to refine understanding among participants.

All groups except for southeast decided that separate sets of criteria were needed to judge importance among fishery units (Table 2) and among the goals, objectives and information needs of the hierarchies (Table 3). Some groups assigned values to their sets of criteria for judging importance.

Table 2. Criteria for judging importance among fishery units and their fish species or stock, by area (values of importance are in parentheses).

Area	Criteria
Copper River/Prince William Sound	1. Is a primary subsistence resource; or, could become targeted in 3-5 years (high). 2. The extent of federal jurisdiction over the fishery (high). 3. The degree of allocation issues with competing uses of the resource (medium). 4. The extent of vulnerability to overharvest (medium).
Bristol Bay/Chignik	1. Degree of resource allocation and corresponding management intensity (primary). 2. Extent of federal jurisdiction over the fishery (primary). 3. Vulnerability of stocks to over harvest and other conservation concerns (primary). 4. Importance of resource to subsistence users (secondary). 5. Magnitude of harvest (secondary). 6. Number of fishery participants (secondary). 7. Role of resource in the subsistence way of life (secondary).
Kodiak/ Aleutians	1. Traditional use of certain salmon species by family or area. 2. Federal *nexus* of the various salmon fisheries. 3. Increasing harvest and use of Chinook salmon in marine waters during the winter. 4. Availability of species (e.g., pink and chum) which have two-year abundance cycles.

Table 3. Criteria for judging importance among goals, objectives, and information needs by area (values are in parentheses).

Area	Criteria
Copper River/Prince William Sound	1. The extent to which knowledge about the resource provides for sustainability (high). 2. Ability to estimate socioeconomic benefits to rural subsistence users (mid-high). 3. The extent of uncertainty; the consequence of not having full knowledge (medium).
Bristol Bay/Chignik	1. Vulnerability of stocks to over harvest. 2. Degree of resource exploitation. 3. Importance of resource to users. 4. Degree of resource allocation and occurrence of allocation disputes. 5. Management consequences of uncertainty (risk).
Kodiak/ Aleutians	1. Sustainability of fishery resources (including vulnerability to over harvest, effects of habitat loss or changes, and management consequences of uncertainty). 2. Harvests and uses (including degree of exploitation, importance to users, accuracy of harvest data, and degree of allocation). 3. Role and importance of fishery resources in sustaining ecosystems.
Southeast	1. Degree of federal jurisdiction and interest. 2. Feasibility of addressing the concern in the plan's time horizon (3-5 years). 3. Magnitude of resource use. 4. Concerns regarding sustainability of a population, or populations within an area. 5. Other funding sources. 6. The consequences of not knowing (degree of uncertainty).

2.5 Establishing priorities

Using the above criteria as guidelines, groups were asked to use their expert judgment in individually assigning ratings of importance to each level (goals, objectives, or information needs) of the hierarchy. The relative importance of the goals under consideration was evaluated, then that of the objectives within each goal, then that of the information needs within each objective. Participants were given time to think and write their ratings of importance down on paper before sharing their judgments. A modified positive ratio scale with associated verbal equivalents (after Saaty, 1999) was used to rate importance, where numbers between those listed (e.g., 2, or 2.5, etc.) were used to interpolate meanings as a compromise:

Scale of Importance	Definition
9	Extreme importance
7	Very strong importance
5	Strong importance
3	Moderate importance
1	Slight importance

Elements judged to be of equal importance were given equal scores. Consensus within a range of two to three points on the rating of elements was usually achieved among participants. When disparity in judging importance occurred, it meant there was disagreement, and discussion was encouraged. Debates advanced the understanding of important concepts and often resulted in a clearer definition of the goal, objective or information need. By seeking consensus not only was dialogue and learning encouraged, but also the formation of a group solution, rather than individual solutions, was promoted.

Expert Choice was used interactively to depict the influence of weights and derive the priority of information needs. Priorities approximate the strength of importance for each information need adjusted to reflect the importance assigned to the objective addressed by that information need. Mathematically,

relative ratings of importance are entered into a vector and normalized. The values from the vector are then multiplied by the weight in the next highest level, and the result is the weight of importance for information needs. The total score for each information need is then calculated by adding the weighted proportions over all objectives within a goal:

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

where

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

2.6 Structural adjust

While approximate balance in a hierarchy is desired, strategic planning problems do not always lend themselves to balance. Structural imbalance can lead to dilution of the weight of many variables, so adjustment is made to the priorities of the children, based on the total number of grandchildren. Structural adjustment must always be carefully examined to see if the results capture the intended proportion of weight and make sense. In a conceptual example, consider that if an objective (A) has four information needs, and another objective (B) has two information needs, then there are six information needs 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 information needs are not diluted simply because there are many of them.

2.7 Gap analysis

Prior to the second planning workshop, participants were asked to contribute to an inventory of all relevant projects pertaining to information needs identified in the first workshop. The inventory was developed in a spreadsheet and included location, fish species addressed, summary of the information collected or specific activity, project duration, funding source, current status, and an assessment of how well the project addressed the information need. The inventory provided the basis for the gap analysis.

At the second workshop, the analysis of gaps in knowledge occurred as follows:

- Participants formed into sub-groups according to expertise and using the project inventory, they first summarized the current state of knowledge for each information need using three categories, "adequate", "partially known", and "largely unknown"; and,
- Recommendations were made as to what actions should be taken over the next 3-5 years to address each information need using two categories, "no action" or "consider proposals".

Standardized responses were developed for each assessment (Table 4) to clarify both what is known and what needs to be done for subsistence fisheries management and assessment. For example, while knowledge regarding an information need may be judged as adequate to guide management, a proposal may still be considered for funding because the research need is ongoing. Conversely, while knowledge regarding an information need may be inadequate, no proposals will be considered ("no action") because the need to know may be intermittent, or awaiting a literature synthesis.

In the case of the southeast group, large numbers of sockeye salmon stocks precluded assessing information needs for all stocks. Rather, analysis addressed which sockeye salmon stocks are of greatest importance to assess priority information needs by examining stock studies, subsistence harvest and exploitation, importance to local communities, management actions, and relevance to federal oversight.

Table 4. Responses to assess state of knowledge and recommend actions, by information need.

Current state of knowledge	What needs to be done?
Knowledge is adequate Definition: There is little uncertainty regarding this information need. The existing program provides sufficiently accurate and timely information to give meaningful guidance to managers.	**No action** Definition: Project(s) are in place or have been completed. Funding is committed and adequate through the next funding cycle. **Consider proposals** Definition: Maintenance of this data base or activity is required because there is an ongoing need. Or, there are inadequate projects to address this information need. Funding is not committed, or is currently inadequate, to address this information need through the next funding cycle. It is a strategic priority of the Monitoring program to consider new proposals under this information need at this time.
Knowledge is partially known Definition: There is some uncertainty regarding this information need. The existing program provides some information; however, historic project results may need updating, or, there is a project in place but it may need to be improved to give meaningful guidance to managers.	**No action** Definition: Project(s) are in place or have been completed. Funding is committed and adequate through the next funding cycle. **Consider proposals** Definition: There are inadequate projects to address this information need. Funding is not committed, or is currently inadequate, to address this information need through the next funding cycle. It is a strategic priority of the Monitoring program to consider new proposals under this information need at this time.
Knowledge is largely unknown Definition: There is much uncertainty regarding this information need. The existing program provides little or no information. Few, if any, projects have been conducted; or, results of projects are incomplete or inadequate. There is virtually no information to give meaningful guidance to managers.	**No action** Definition: Synthesis of information is being conducted, or circumstances have determined that this information is not necessary or only intermittently needed. **Consider proposals** Definition: There are inadequate projects to address this information need. Funding is not committed, or is currently inadequate, to address this information need through the next funding cycle. It is a strategic priority of the Monitoring program to consider new proposals under this information need at this time.

3. Results and discussion

3.1 Strategic Priorities

Proposals considered for funding under the Monitoring Program must show federal nexus, or interest, and have a direct association to a subsistence fishery. Thereafter, proposals are evaluated against the priority of information needs. Projects focused on high priority information needs should lead to more effective management of subsistence fisheries.

Each group discussed the three goals of the Monitoring Program at length, and clarified concepts by specifying objectives and the information needed to attain the goals (Figures 2-5). Goal #1 comprised biological considerations including estimates of salmon abundance, composition, timing and distribution, as well as developing an understanding of critical factors that affect production. Two groups expanded

discussion into the role of salmon in ecosystem functioning. Distinct to the Copper River/Prince William Sound and Kodiak/Aleutians groups were concerns relating to enhancement activities and effects on wild salmon. Goal #2 comprised management, cultural and social considerations including estimates or descriptions of salmon harvest, effort, methods, timing location, and demographics, as well as developing an understanding of critical factors that affect subsistence use patterns. The ability to predict future use was a concern of participants from the Bristol Bay/Chignik and Kodiak/Aleutians areas. Participants from all areas expressed suspicion of subsistence harvest data, and stated the need to increase harvest data accuracy. Goal #3 was regulatory in nature and included collecting information on customary trade to answer specific regulatory questions, evaluation of management strategies, development of effective information sharing systems, and assessment of competing fisheries. The southeast group had few regulatory concerns and so combined concepts relating to Goals #2 and #3 into one goal.

Goal		Objective		Information need
0.495	Obtain, develop & improve information to sustain fish populations necessary to provide for subsistence uses	0.211 Characterize & define abundance, composition & timing of salmon populations that sustain subsistence fisheries	0.068	Estimate or index total run abundance by species
			0.062	Determine timing & migratory patterns for wild stock, sex & age
			0.044	Determine timing & migratory patterns for hatchery stock, sex & age
			0.037	Identify, catalog & assess stocks
		0.188 Evaluate spawning escapement needed to sustain subsistence fisheries	0.055	Obtain reliable estimates of spawning escapement over time & across escapement ranges
			0.049	Estimate distribution of spawning populations
			0.046	Describe relationship between escapement & production
			0.038	Document historic escapement levels
		0.096 Identify & characterize critical factors that affect population dynamics	0.036	Evaluate critical attributes of life history affecting production
			0.032	Assess impacts of fisheries on stock specific production
			0.028	Determine effects of hatchery production on wild fish escapement
0.321	Assess & monitor subsistence fisheries to document & provide for subsistence uses	0.181 Document & estimate subsistence harvest & effort	0.063	Estimate subsistence harvest by location, gear type, species, size, age
			0.046	Evaluate quality of harvest data
			0.039	Characterize stock structure of the harvest
			0.033	Assess inseason subsistence harvest & effort
		0.139 Identify & describe past & present harvest & use patterns	0.055	Describe historic & current harvest methods & means by species, area
			0.044	Identify factors affecting subsistence harvest levels
			0.040	Describe & document historic & current fish processing & distribution practices
0.184	Develop & evaluate regulatory & management strategies to provide for subsistence uses	0,095 Assess impacts of other fisheries on subsistence	0.037	Describe total harvest rates by fishery for specific stocks
			0.031	Describe interactions between subsistence & other fisheries
			0.027	Describe socioeconomic impacts of other fisheries
		0.089 Develop & evaluate management strategies for subsistence	0.050	Develop information sharing between stakeholders & agencies
			0.039	Evaluate efficacy of current regulations for subsistence harvests

Figure 2. Hierarchy, including adjusted weights of importance, Copper River/Prince William Sound salmon fishery unit.

Goal		Objective		Information need
0.565	Sustain healthy salmon populations that support subsistence uses	0.374	Determine spawning escapement needed to sustain subsistence fisheries	0.179	Obtain reliable estimates of spawning escapement over time
				0.069	Describe relationship between escapement & production
				0.064	Identify critical factors that affect population dynamics
				0.040	Determine escapement by river/lake system to sustain ecosystem function
				0.022	Relate historic salmon harvest to current productivity in river/lake system
		0.191	Characterize & define abundance, composition & timing of salmon populations	0.093	Estimate abundance of total run by species & river/lake system
				0.066	Determine adult timing & migration patterns by stock sex, size & age
				0.032	Define & catalog management units that sustain subsistence fisheries
0.337	Document subsistence uses	0.134	Document the current fishery	0.091	Annually estimate harvest & effort by location, gear type, species, date
				0.044	Independently verify permit data
		0.130	Identify & describe trends in past & present use patterns	0.040	Estimate historic harvest levels & effort; evaluate trends & data quality
				0.035	Identify & evaluate factors affecting subsistence uses
				0.021	Document changes in harvest timing & factors affecting those changes
				0.018	Describe current & historic fish processing & distribution
				0.016	Describe historic & current harvest methods & means by species & area
		0.073	Project future use patterns	0.026	Gather local perspectives on future use patterns
				0.035	Evaluate key factors influencing future use patterns
				0.013	Build process based models to predict future use patterns
0.099	Effective management to provide for subsistence uses	0.056	Develop & evaluate management strategies	0.023	Evaluate efficacy of regulations for subsistence harvest
				0.020	Develop information sharing
				0.013	Examine alternative management strategies
		0.043	Assess impacts of other fisheries	0.026	Describe socioeconomic & cultural impacts of other fisheries
				0.017	Describe total harvest rates by fishery for specific stocks of interest

Figure 3. Hierarchy, including adjusted weights of importance, Bristol Bay/Chignik salmon fishery unit.

Goal		Objective		Information need
0.433	Obtain biological information to provide for subsistence uses	0.235	Describe abundance composition & timing of salmon populations	0.071	Estimate abundance of total run by species & river/lake system
				0.069	Obtain reliable estimates of spawning escapement over time
				0.062	Determine adult run timing & migration patterns by stock, size, age
				0.033	Define & catalog management units for subsistence fisheries
		0.198	Determine salmon production needed to support fisheries	0.062	Identify factors affecting population dynamics, e.g., enhancement
				0.060	Describe relationship between escapement & production
				0.046	Determine escapement by river/lake system to sustain ecosystem function
				0.030	Relate historic harvest to current productivity of river/lake systems
0.328	Assess & monitor subsistence fisheries to document uses	0.155	Document the current fishery	0.099	Estimate annual use, harvest, effort by location, geartype, species, date
				0.042	Improve reporting systems for federal subsistence harvests
				0.014	Independently verify harvest data
		0.128	Identify & describe past & present subsistence harvest	0.064	Identify factors affecting subsistence harvest levels
				0.033	Describe current & traditional methods & means by species, area
				0.031	Describe current & traditional uses & distribution practices
		0.045	Project future use patterns	0.023	Gather local perspectives on future use patterns
				0.018	Evaluate key factors influencing future use patterns
				0.004	Build process based models to predict future use patterns
0.239	Effective management to provide subsistence uses	0.151	Develop & evaluate management strategies for subsistence harvests	0.063	Examine the efficacy of current regulations for subsistence harvest
				0.056	Develop real time information sharing among user groups & agencies
				0.032	Examine alternative management strategies
		0.088	Assess impacts of other fisheries	0.044	Describe socioeconomic impacts of other fisheries
				0.044	Describe harvest rates by fishery for specific stocks

Figure 4. Hierarchy, including adjusted weights of importance, Kodiak/Aleutians salmon fishery unit.

Goal		Management Question		Information need
0.485	Obtain develop & improve information to sustain fish populations necessary to provide for subsistence uses	0.296	What are spawning stock abundances over several life cycles?	0.183	Need to estimate current escapement
				0.061	Need to estimate the historical escapement & or run
				0.051	Need to characterize the functional biological groups in a lake
		0.066	What are freshwater habitat factors that affect productivity?	0.035	Need to describe the current conditions of freshwater habitat
				0.031	Need to describe the historical conditions of freshwater habitat
		0.053	What are the critical attributes of life history that affect production?	0.034	Need to know the age & sex composition of adults
				0.019	Need to know survival & freshwater factors affecting survival
0.586	Assess & monitor subsistence fisheries to document & provide for subsistence uses	0.182	What are subsistence needs by stream/lake system/community?	0.100	Need to understand factors impacting subsistence exploitation rates
				0.082	Need annual variation in needs & why (factors affecting variability)
		0.164	What is annual harvest & effort by stream/lake system/community?	0.164	Need to develop & evaluate an accurate harvest reporting system
		0.124	What are subsistence patterns & uses?	0.082	Need to reconstruct historical patterns & uses by location & time
				0.042	Need to know the community distribution networks
		0.116	What are the impacts of other sockeye fisheries on subsistence (by location & time)	0.098	Need to know the stock composition in commercial fisheries
				0.019	Need to understand how sportfishing harvest & effort affect subsistence harvests, by location &time

Figure 5. Hierarchy, including adjusted weights of importance, southeast Alaska salmon fishery unit.

All groups except from southeast rated Goal #1 as the highest priority because it addresses the conservation mandate, which is the foundation to providing for subsistence uses (Figure 6). The southeast group concluded that estimating subsistence harvests is foundational to determining subsistence needs, which in turn augments understanding of harvest patterns and customary and traditional practices. The southeast group also considered substantial investments made to date to assess salmon escapements.

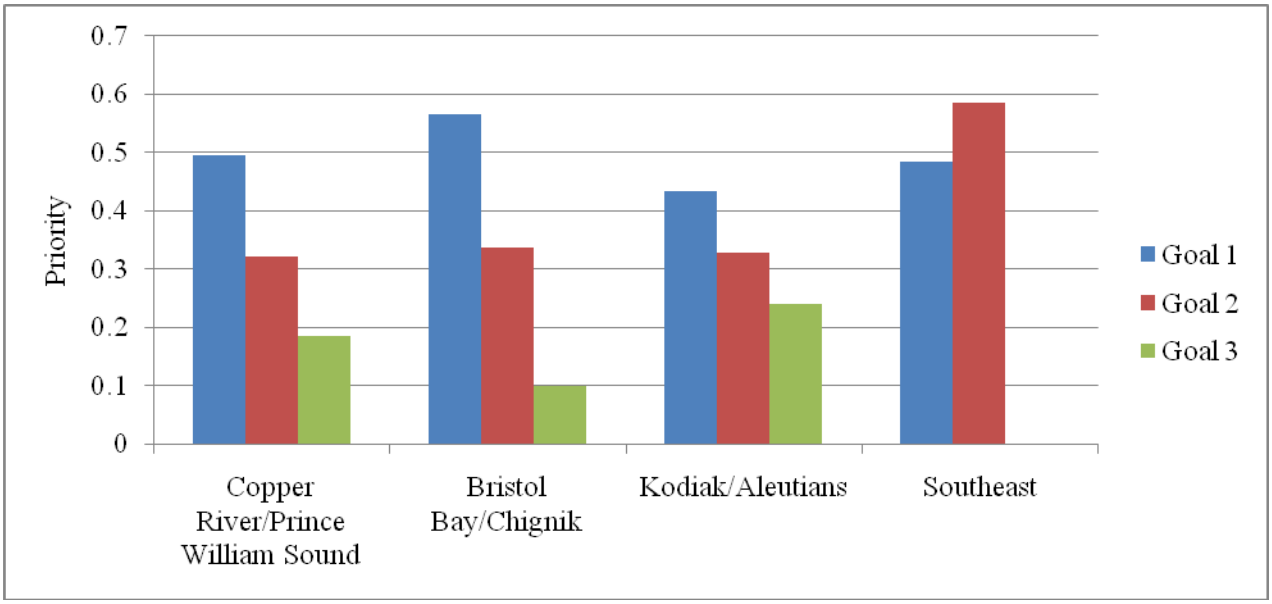

Figure 6. A comparison of goal priorities, by area.

Groups raised broad principles that pertain to all goals and areas and thus lie outside of the hierarchies. For example, traditional ecological knowledge (TEK) is a method that is applicable to all goals. Similarly, capacity building is a desired outcome for all projects. The need to explore alternative subsistence management strategies was considered crucial on a statewide scale. Timely and full utilization of information provided by the Monitoring Program is encouraged to resolve management questions for subsistence fisheries, irrespective of jurisdiction. Ensuring investment into exploratory research and more cost efficient methodology, technology and/or approaches was recommended.

3.2 Application of the gap analysis to strategic priorities of information needs

Synthesis of priorities for information needs was conducted within each goal, and over the entire hierarchy, combining information needs from all three goals. Synthesis of information needs at the goal level clarifies three specific areas of study which can be helpful to collaboration with other planning efforts. However, it is the synthesis of information needs over the entire framework that is intended to clarify strategic priorities for the Monitoring Program. For the sake of brevity, only synthesis over the entire hierarchy will be discussed in this paper.

Using information from the project inventories specific to each area, the groups identified knowledge gaps for federal management of salmon subsistence fisheries. Recommended actions from the gap analysis (see Table 4) were overlaid with the priority ranking of information needs (Figures 2-5) to identify the highest strategic priorities in each of three areas for the annual monitoring plan (Figures 7). In the case of the southeast group, all information needs have strategic priority. Those sockeye salmon stocks to which the information needs apply for soliciting proposals in the 2007 funding cycle in rank order were: Klawock Lake, Falls Lake, Hetta Lake, Klag Lake, Hatchery Creek and Kanalku Lake.

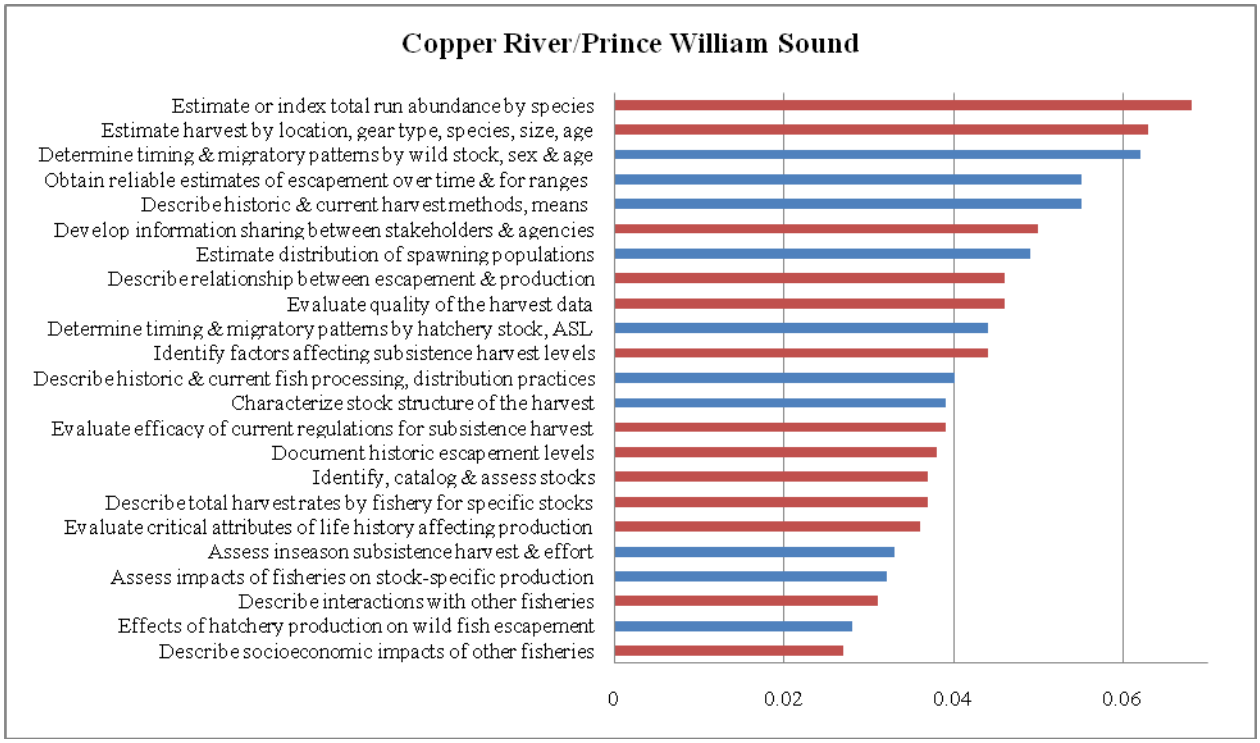

Figure 7. Priority of information needs recommended for proposals from the gap analysis, shown as red bars, by area. Blue bars indicate “no action”.

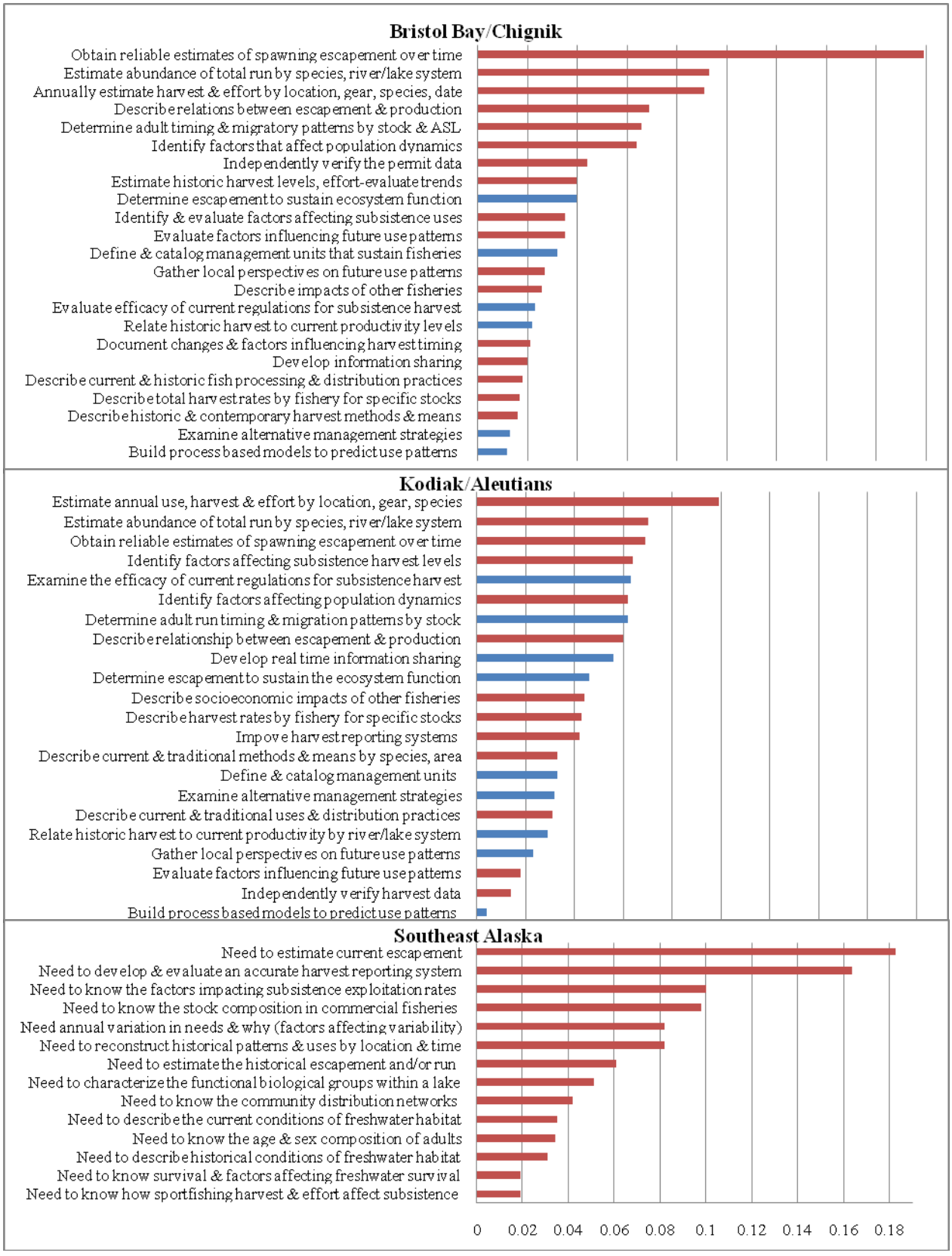

Figure 7. Continued.

For all areas, the majority of information needs were recommended for solicitation of proposals. The Bristol Bay/Chignik and Kodiak/Aleutians groups made similar recommendations for "no action" regarding five information needs with the following general rationale: it is preliminary to build models predicting future use until sufficient data are collected; knowledge is deemed adequate to catalog management units; alternative management strategies should be considered through the Federal Subsistence Board, not the Monitoring Program; there is no direct tie to subsistence with respect to determining escapement needed to sustain ecosystem function; and, results are pending from an ongoing study examining the relationship between historic harvests to current productivity.

Major achievements from the planning meetings included combining strategic priorities with a gap analysis to develop an explicit call for proposals in funding the highest priorities for management of federal subsistence fisheries. The planning efforts were a major undertaking, spanning two years, however OSM was pleased with the rigorous and comprehensive analysis of information needs provided by stakeholder groups. Participants generally accepted the process of stakeholder involvement in decision-making. The plan is envisioned as being dynamic in that analyses can be updated annually, providing a timely mechanism to identify strategic priorities for information in each year's plan.

3.3 Evaluation survey for group decision-making

Participants benefit from the planning meetings by gaining increased knowledge and awareness of research and management concerns fostered through facilitated discussions, and by sharing dialog with new people. Following planning meetings, an evaluation survey should be given to participants to solicit feedback on their perceptions of the planning process and suggestions for future meetings (Table 5).

Table 5. Example evaluation survey from strategic planning, Bristol Bay/Chignik area, 2004. Summary responses from this workshop are in italics.

We would like to hear your thoughts on the meeting to help us improve future meetings.

Please mark an X in the box corresponding to your response regarding the time allotted per phase.

Phase	Too much time	Too little time	Adequate-about just right
Introduction	*30%*		*70%*
Training			*100%*
Structuring		*12%*	*88%*
Priority-setting		*38%*	*62%*
Review	*14%*	*72%*	*14%*

Degree to which the planning process held your interest? *Average = 4.2*

Boring	A little boring	Neutral	Generally interesting	Interesting & innovative
1	2	3	4	5

Degree to which the planning process was efficient and effective? *Average = 4.0*

Not much	Somewhat	Neutral	Generally	Very
1	2	3	4	5

Overall general satisfaction with the meeting experience? *Average = 4.0*

Very dissatisfied	Somewhat dissatisfied	Neutral	Generally satisfied	Very satisfied
1	2	3	4	5

Overall general satisfaction with the outcome? *Average = 4.1*

Very dissatisfied	Somewhat dissatisfied	Neutral	Generally satisfied	Very satisfied
1	2	3	4	5

Do you feel that generally your concerns were considered by others and included in the plan?

Yes_____*100%* No_____

What did you like best? *The voting process was very effective, the hardware worked well. The outcome.*

What should be improved? *Need time to think. Shorter breaks and more frequent.*

Thank you for your time!

Some participants indicated that more time was needed for planning. Completeness and accuracy of a plan is influenced by the length of time that is allotted to planning as well as expertise and opinions of participants. The commitment necessary for a meaningful length of time for group participation may be difficult to obtain. For this process, five days were partitioned into two separate meetings, allowing time in-between for review and reflection. Considering the size of the geographic area, multiple fisheries and agency jurisdictions involved, the workgroup arrived at remarkable consensus in an efficient manner.

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