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Introduction

Over 75% of the area of Washington State is now covered by the listings of wild salmon, trout, and/or char[1] under the federal Endangered Species Act (ESA). In January, 1999, Governor Locke released a draft of Washington's multifaceted Statewide Salmon Recovery Strategy (SSRS), developed over the last year by the Joint Natural Resources Cabinet (Joint Cabinet). The purpose of the SSRS is to protect and restore wild salmonids and their habitat. This includes not only restoring those stocks listed under the ESA, but protecting healthy stocks to prevent the need to list or respond to listing decisions in the future. Through various approaches the draft SSRS addresses all 4Hs: harvest, hatcheries, hydropower, and habitat; however, its focus is habitat. The investment by the Governor and the Joint Cabinet in addressing the goal of the SSRS represents the first coordinated statewide approach to protect and restore habitat for wild salmonids.

Accomplishing the goals of the SSRS and its associated implementation plans will take considerable effort, will require forming new coalitions and ways of working together, will require facing difficult choices, and will place new demands on limited fiscal resources. Effective approaches will be needed to identify and prioritize recovery activities that can be expected to do the most good for recovery of wild salmonids at appropriate spatial scales (project site, watershed[2], region[3], Evolutionarily Significant Units (ESUs)).

Scientifically-based approaches and tools to help prioritize conservation and recovery efforts for salmonids at risk are receiving increasing attention in the scientific literature (Allendorf et al. 1997; Lunetta et al. 1997; Mobrand et al. 1997; WDFW 1997; Moyle and Randall 1998). Bradbury (1995) outlined a framework to prioritize watershed recovery efforts in Oregon. Prioritization efforts may involve many elements, either individually or collectively, including: (1) factors affecting salmonid production, (2) evaluations of biologic and/or habitat conditions, (3) species and/or stocks, (4) cost and benefit analyses, and (5) emphasis at different spatiotemporal scales (e.g., project, watershed, or metapopulation/ESU/region).

The draft SSRS contains a chapter entitled *Priorities for use of new funding for habitat protection and restoration* (chapter III.F.4.). That chapter clarifies an initial context and need for prioritization and allocation of resources to effectively and efficiently benefit salmonid recovery. It

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[1] Salmon, steelhead, trout, and char are members of the family Salmonidae. These fish are known collectively as salmonids. As in the draft Statewide Salmon Recovery Strategy, any use of the term salmon is intended to mean salmon, steelhead, trout, and char - salmonids.

[2] The term watershed is generally reflected in the draft Statewide Salmon Recovery Strategy in the context of Water Resource Inventory Areas (WRIAs). WRIAs are the fundamental watershed unit used in this prioritization framework.

[3] Use of the term regions is intended to be consistent with its use in the draft Statewide Salmon Recovery Strategy, wherein it refers to salmon recovery regions across the state.

reflects the policy options and decisions of the Joint Cabinet, and is based on the scientific principles outlined in the "Science as a Guide" chapter (III.A) of the draft SSRS.

In general, the long-term prioritization goal for Washington's salmonids, consistent with the draft SSRS, is to:

> ***Ensure that funding is used effectively for activities that have the highest likelihood of contributing to recovery in the shortest possible time, within the constraint of available resources and capabilities.***

The prioritization framework described in the draft SSRS identifies the overarching need for development and application of a comprehensive approach to guide efforts for all 4Hs (habitat, harvest, hatcheries, hydropower) at multiple scales (within and between regions and watersheds). **Figure 1** illustrates salmonid recovery regions across Washington as identified in the draft SSRS. Water Resource Inventory Areas (WRIAs) are the fundamental watershed-oriented geographic unit used in the draft Statewide Salmon Recovery Strategy.

The emphasis of the framework described in the draft SSRS was limited to habitat protection and restoration only. It outlined an initial procedure, analysis, and list of priority WRIAs for distribution of new funding **between WRIAs** across the state. As described in the draft SSRS, separate processes to prioritize habitat protection and restoration efforts for activities to address factors limiting wild salmonid production **within WRIAs** are needed. To that end, in 1998 the legislature passed and Governor Locke signed, ESHB 2496. That legislation created processes to identify limiting factors and analyze critical paths to address them under the auspices of the Washington State Conservation Commission. In 1999, the legislature passed additional legislation pertaining to management and distribution of funds intended to support salmonid recovery efforts.

The Interagency Science Advisory Team (ISAT) was created by the Joint Natural Resources Cabinet to provide scientific support in development of the SSRS. ISAT is comprised of scientists from Joint Cabinet agencies and other scientists invited by the Joint Cabinet.

Early in 1999, the Joint Cabinet requested that ISAT assist in the effort to develop a prioritization approach by reviewing scientific aspects and refining the foundation provided in the draft SSRS. The results this work are intended for use in development of policy and administrative guidance for the allocation of resources (e.g., state, federal, other) and other salmonid recovery efforts.

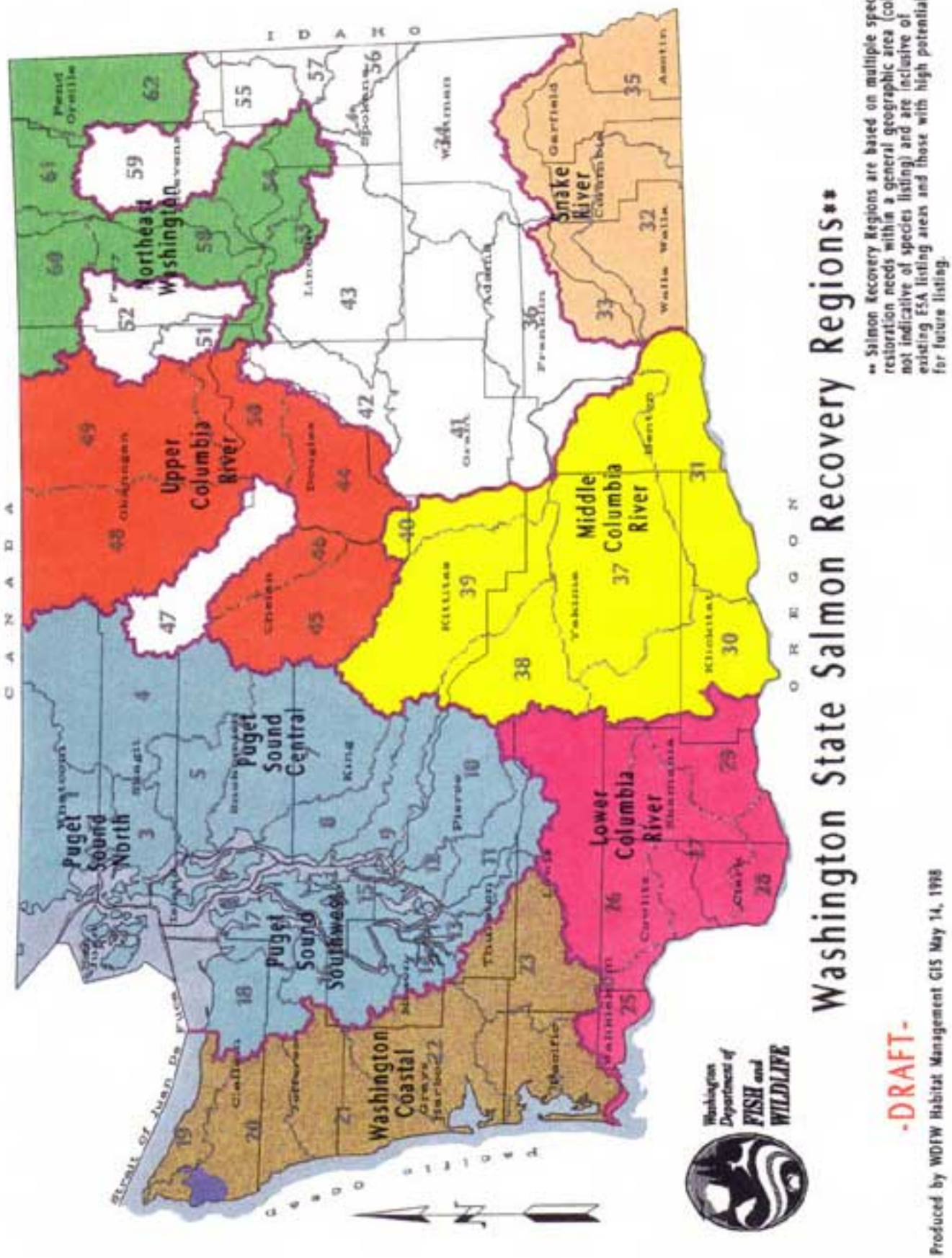

Figure 1. Map of Washington showing Water Resource Inventory Areas and salmon recovery regions. From the draft Statewide Salmond Recovery Strategy.

The purpose of this document is to extend the prioritization effort put forth in the draft SSRS and support the short-term objective noted below. Consistent with the draft SSRS, WRIAs were the smallest spatial scale used in this prioritization framework. This framework continues to focus on habitat; identification, assessment, and synthesis of additional information would be needed to address all four Hs in future prioritization activities.

- **Short-term objective:** Develop and refine the scientific principles and basis for determining which WRIAs are the highest priorities for use of new funding for salmonid habitat protection and restoration in western Washington.

- **Long-term objective:** Adapt and expand the scientific principles and approach to guide use of resources to address all four Hs across WRIAs statewide.

It is important to note that this habitat-oriented WRIA prioritization framework for salmonids in western Washington could be adapted for use in eastern Washington.

As defined in the draft SSRS, the term habitat "**protection**" encompasses efforts to prevent loss or degradation of habitat and its functions through actions, such as acquisition of property and development rights, to preserve habitat and aquatic salmonid communities, including life history diversity. Protection also includes actions to prevent loss or degradation of either high quality habitat or habitat that has already been degraded. The term "**restoration**" is defined to encompass efforts to correct to some level loss or degradation of habitat and its functions that has occurred, including efforts to rehabilitate some portion of habitat functions that have been lost or degraded. Restoration of habitat and its functions may also occur passively, without active intervention, if the conditions causing the loss or degradation are prevented or corrected. Most actions can be classified as either protection or restoration; but a given action may have both protective and restorative benefits.

It is important to pause and emphasize several points about this report. First, the system described here for prioritizing WRIAs for habitat protection and restoration is intended to provide a reasonable, scientifically based coarse-scale approach to prioritization needs, making use of available information. It proposes and illustrates an option for possible use by decision-makers in their efforts to determine where protection and restoration actions might produce the most effective and efficient outcomes in general for salmon, steelhead, trout, and char. ISAT's system was not intended to represent the only approach to prioritization issues. Policy overlays or alternative technical approaches may also be appropriate.

Second, it is important to emphasize that this system is not intended to provide a direct approach to all needs and conservation responses to listings and/or proposed listings under the Endangered Species Act (ESA). An attempt to more directly address priorities to address ESA issues would be most effective once goals for specific salmonid populations or habitat recovery goals for watershed, regions, ESUs, or groups of ESUs are available. Technical and policy guidance associated with recovery goals was not available for ISAT's use in development of this system.

Finally, the framework is not intended to provide a risk assessment, or to represent an analysis of critical high risk fish or information categories. There may indeed be circumstances that call for emergency efforts, but they should not be expected to be identified through this system.

Figure 2 provides a more detailed illustration of the regions, WRIAs, and major river systems in western Washington.

Scientific principles and conceptual framework

The ecosystem and watershed-oriented scientific principles outlined in the "Science as a Guide" chapter of the draft SSRS (chapter III.A) were used to develop this prioritization framework. These principles emphasize the need to address both salmonid protection and restoration in a context that considers the continuum of habitats that salmonids may be subjected to during their life cycle (i.e., upland areas, tributaries, mainstems, estuaries, nearshore marine areas, ocean, and their interconnections). The scientific principles also emphasize the structure afforded by biological and salmonid genetic diversity, and the role humans play in influencing the condition of Washington's salmonid ecosystems. They emphasize the need to address causes of degradation of watersheds and ecosystem functions and processes, not the symptoms of degradation, presuming recovery of properly functioning salmonid populations and habitat systems is the goal.

From a long term perspective, salmonid conservation and recovery will be most efficient and effectively beneficial if protection efforts are emphasized. As in the case for the medical profession, common sense tells us it will be more effective and less expensive to keep a patient

Figure 2. Map of western Washington showing salmon recovery regions, Water Resource Inventory Areas, major river systems, and communities.

from becoming ill or injured in the first place than to try to heal or repair them afterwards. The same is the case for salmonids and their ecosystems. Once degradation has occurred to the extent that restoration approaches are needed, such approaches typically require substantial investments to accrue benefits that are even marginally similar to those present before the degradation occurred in the first place. In addition, protection approaches are generally more reliable and likely to succeed than restoration. Although ISAT acknowledges there are many ongoing and dedicated efforts to improve efficient and effective design and implementation of restoration practices, the efficacy of such practices remains largely unproven in the scientific literature (e.g., Reeves et al. 1997, and references therein), especially in terms of their ability to achieve and sustain long term recovery of salmonids and their ecosystems. An orientation toward protection approaches has been repeatedly articulated in the scientific literature (e.g., FEMAT 1993; National Research Council 1992, 1996; Frissell 1997; McGurrin and Forsgren 1997).

The draft SSRS (chapter III.F.4) proposed to emphasize protection over restoration in a policy context. Beyond a general base allocation of 20%, the stated priority for use of new funds for habitat restoration and protection was 60% for protection and 40% for restoration efforts. These percentages resulted from Joint Cabinet deliberations regarding policy issues and options, as guided by the best available scientific information. It was not ISAT's charge to review the appropriateness of these percentages. Instead, ISAT's intent was to help identify priority WRIAs within which restoration and/or protection activities would be expected to contribute the most to effective recovery, in the shortest possible time, and using the least amount of effort/resources.

Consistent with the goal of this prioritization framework is a fundamental emphasis on the efficient use of available resources. The framework was designed to allow ranking of individual WRIAs on the basis of assumptions about efficiencies. If, on the other hand, efficiency is not the desired way to view recovery, then ISAT's intent was to provide adequate information about the elements of a ranking system and related information that will allow WRIAs to be ranked according to alternative criteria (e.g., species emphasis, rivers with moderate amounts of human disturbance). It was also ISAT's intent to acknowledge the limitations of the approach used, and to provide recommendations for consideration in possible future iterations.

Salmonid life cycles and habitat requirements

The discussion below was extracted from the "Science as a Guide" chapter of the draft Statewide Salmon Recovery Strategy. It provides a very brief introduction to the life cycles and habitat requirements of Washington's salmonids. It is intended to encompass several species of the salmonid genus *Oncorhynchus* including: chinook, pink, coho, chum, sockeye, steelhead/rainbow trout, and coastal and westslope cutthroat trout. In addition, wild bull trout and Dolly Varden, which are char of the genus *Salvelinus*, also exist in the state. These species may have anadromous and non-anadromous forms. Each species is comprised of many component stocks and populations, which vary from one another in their genetic, life history, and other characteristics.

Anadromous salmonids spend part of their lives in freshwater where they spawn, their eggs incubate and hatch, and juveniles rear. After varying periods of freshwater residence, depending on the species, the juveniles go to marine environments as "smolts" to feed and grow to adulthood. Ocean-going salmonids acquire most of their adult size during their ocean residence. Except for steelhead and the resident trouts and char, all Pacific salmon die after returning to spawn. Upon death, anadromous salmonids return critically important marine derived nutrients to our watersheds, nutrients that the productive potential of our salmonid stocks may depend on. Trout have the potential to survive to spawn more than once. Non-anadromous salmonids stay in freshwater their entire lives, but seldom achieve as large a size as the ocean forms, at a given age.

All species of Washington's salmonids have basic requirements for them to exist. If any, or all, of these requirements are not maintained in a healthy state, then populations will decline over time and eventually either go extinct or change in character. These requirements are:

1. Salmonid stocks of sufficient abundance and genetic diversity with which to build on.

2. Upstream and downstream access to and from spawning and rearing habitats. This includes all blockages from large hydroelectric dams on large rivers to road culverts or diversions on small streams.

3. Abundant clean and cool water. Salmonids evolved in cold water free of toxics and other pollutants.

4. An accessible food supply in freshwater, estuaries, and in the ocean. This usually comes from a healthy riparian ecosystem and an abundance of salmon carcasses on the spawning beds.

5. Abundant clean gravels in which to spawn. This means gravels without fine particulate sands in excessive amounts.

6. Habitat complexity and quality in the form of properly functioning and dynamic systems with deep pools and shallow riffles, as well as properly functioning estuary and ocean environments.

7. A balanced population of natural predators (i.e., insects, fish, birds, and mammals). Salmonids have evolved in the presence of predators, which impose an important selective force which contributes to the fitness of salmonid stocks.

In summary, healthy salmonids need healthy watersheds and healthy functioning ecosystem conditions. Key overarching needs include diverse biological communities, genetic diversity, and functional watershed and ecosystem processes. All factors that impact the needs of salmonids (e.g., harvest, hatcheries, habitat, hydropower) must be addressed to ensure recovery and protection of healthy stocks, their watersheds, and their ecosystems.

Conceptual approach and methods

A fundamental assumption in conservation or recovery planning intended to improve conditions for degraded populations and their habitats is that the health of population(s)/species of interest will respond positively to the reduction or elimination of factors causing the declines. In other words, the health of salmonid populations/species is a function of factors affecting their production. These factors may be individually and cumulatively associated with human and/or naturally occurring activities and processes. This relationship is illustrated conceptually in **Figure 3** below.

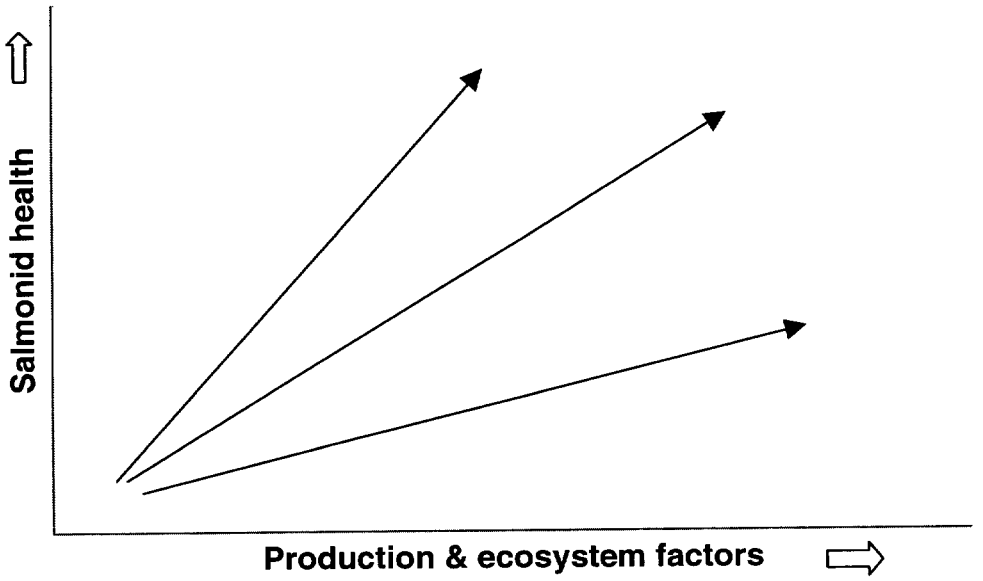

Figure 3. Conceptual diagram illustrating the relationship between salmonid production and ecosystem factors and health of salmonid populations.

To address the short-term objectives of this prioritization exercise (habitat and western Washington emphasis), ISAT identified two major categories of information associated with the above conceptual relationship. These are: (1) **salmonid populations**, and (2) **salmonid ecosystems**. It is important to note that economic or cost factors were not considered in ISAT's analyses.

Information related to each of the two categories was used to assess the relative extent to which recovery efforts among WRIAs for salmonids and/or their ecosystems might be expected to efficiently benefit wild salmonids in the shortest possible time. In addition, information was used to ascertain the extent to which the relative emphasis of recovery efforts might rely on habitat protection and/or restoration approaches.

Informational components within categories were considered for inclusion if they were available for WRIAs across western Washington. ISAT recognized that information for elements not included here may have been available for many areas, but if information was not available for all of western Washington, they were not included in this assessment. Available information was assembled, analyzed, and rated for individual components of information for each WRIA in western Washington under each of the following two categories:

I. the importance of **salmonid populations** in their ecosystems to their respective evolutionarily significant units (ESU) and species.
   - this category characterizes the status and various features of salmonids and their fishery management context.

II. the importance of the **ecosystem** to salmonids.
   - this category characterizes the habitat and environmental context for salmonid ecosystems/watersheds, and the relative extent to which various elements might benefit from protection and/or restoration efforts.

Organizing information in these categories provides a way to help conceptualize how to compile and relate information regarding protection and restoration of the capacity, productivity, and diversity of salmonids and their habitats to achieve the goal of the draft SSRS. For example, maintaining or restoring quality habitat will not be effective if passage obstructions or harvest in fisheries do not allow full use of the available habitat. In addition, the rate of habitat degradation has to be less than the rate of habitat conservation and improvement for net gains to occur. It is known that different watersheds and associated fish populations have been altered in different ways; some more, some less. Restoring lost habitat, especially those areas affected by major dams or other large un-natural blockages or human impacts, may be impractical without extraordinary and sustained effort and costs over the long term. In contrast, it may be very feasible to improve passage barriers (e.g., road culverts), modify channel constraints imposed by dikes, or reconnect off-channel areas to increase habitat complexity in ways that will benefit salmonids for one or more stages in the continuum of habitats required to support salmonid life cycles.

Pursuing the approach described above required completing a sequence of steps. Some or all of these steps would be expected to be reviewed as the prioritization framework is iteratively improved over time. These steps include: (1) literature review of recent approaches and methodologies and identification of specific information needs and elements; (2) identification and acquisition of the best data available to meet those needs; (3) development of an analytical approach and scoring/ranking system; (4) system verification and testing; (5) revision of systems

as needed; (6) completion of analyses, synthesis, and document/report preparation. ISAT has engaged each of these steps.

ISAT used an analytical approach and rationale in creation of a scoring system that was based on a coarse-scale, multi-species assessment. That required qualitatively or quantitatively sorting each set of data or information into three general subgroupings associated with how favorable a condition of circumstance would be for wild salmonids and/or their ecosystems (e.g., high favorability, medium, low favorability). Unless otherwise noted, for each WRIA each subgrouping was then assigned a point score (e.g., high favorability = 10, medium = 5, low favorability = 0) for that respective component. ISAT acknowledges that this approach oversimplifies many issues. The approach may tend to mask slight but important variations. However, this approach is consistent with ISAT's goal to provide a coarse, multispecies assessment of WRIAs across western Washington.

Assumptions

ISAT made various assumptions in developing and utilizing this prioritization framework. These include:

1. The development and refinement of tools to aid in the prioritization of resources must be based on available information. Thus an iterative approach to prioritization is required wherein improvements should be made as new information, approaches, or analyses become available. This framework builds on the prioritization scheme outlined in the draft SSRS.
2. The information for individual components is of sufficient consistency and quality across WRIAs in western Washington to achieve the purposes of this exercise.
3. Information pertaining to some components is not applicable in two WRIAs (WRIA 2-San Juan and 6-Island), and is unavailable in another (WRIA 29-Wind-White Salmon). The influence of these missing values on the outcome of the prioritization exercise is negligible.
4. The information on individual components reflects true variation among WRIAs. In other words, the characteristics of species and their habitats are highly variable within and among WRIAs; however, the coarse-scale approach used in this exercise is sufficient to discriminate relationships among WRIAs.
5. The use of various informational components that were not completely independent from one another is appropriate for the purposes of this prioritization exercise.

Informational components

The information used in the two categories in this prioritization framework is shown below in outline form. More detail defining each component, clarifying the source and limitations of the information, and the scoring system used for each is contained in **Appendix 1. Appendix 2** contains data summaries, scores, and breakpoints for individual components. *Components shown in the outline below in italics are those that ISAT felt strongly should be included, but were not included because a suitable source of data was not available, or if data were available they were not found to be in useable form.*

I. Value of salmonid populations in ecosystem to an ESU - Inclusive of each fish species and race: spring chinook, summer chinook, fall chinook, summer steelhead, winter steelhead, coho, summer chum, fall chum, odd-year pink, even-year pink, coastal cutthroat, sockeye, native char.

1. Need for conservation
    a. healthy stocks and ESUs not at-risk
    b. unhealthy stocks and ESUs at-risk
    c. stock origin
    d. production type of natural spawners (e.g., wild, composite, hatchery)
    e. genetic diversity

2. Fisheries management context
    a. overfished stocks
    b. spawner numbers
    c. hatchery fish identification
    d. natural production
    e. hatchery-natural ratio
    f. ecological interactions
    g. fish health management

II. Value of ecosystems to salmonids

1. Present ecosystem conditions
    a. estuary development
    b. nearshore marine condition
    c. forage fish
    d. percentage of urban development
    e. human population growth
    f. water quality
    g. percentage of land in agricultural use
    h. forest seral stage along streams
    i. channel gradient (related to fish productivity)
    j. impervious surfaces - road density
    k. hydrologic modification
    l. fish passage constraints

2. Water availability and distribution
    a. water availability for fish
    b. frequency of peak flows
    c. low flow limitations (ratio of minimum levels to natural variability)

3. Extent of intact ecosystem
    a. extent of protected lands (e.g., National Park or Wilderness Area lands).
    b. extent of stronghold areas
    c. aquatic biodiversity

Methods

ISAT used various information to describe the present and future conditions of salmonid populations and their ecosystems. Indices were identified for 10 salmonid and 14 ecosystem components.

ISAT's intent was to first consider the context of the coarse scale of the units being prioritized (WRIAs), and then identify information judged to be a reasonable match to that scale, in terms of the information type and detail. Because of the wide range of conditions and fish species/populations and their management circumstances within each WRIA, ISAT looked for general indices that could be expected to form reasonable surrogates of WRIA-specific ecosystem or salmonid population conditions. For example, the Elwha and Dungeness rivers are in the same WRIA but have very different factors affecting the health of wild salmonids present. One of these rivers (Elwha) contains two mainstem dams that totally block upstream migrations of anadromous salmonids, while the other does not; stocks in that river are faced with different limiting factors.

ISAT used several criteria in assessing and selecting information components. With few exceptions, information components used had to:

- provide general measures or indices of salmonid or ecosystem conditions,
- be available for all WRIAs in western Washington,
- be available from existing databases or scientific studies, and
- rely on data that, in ISAT's judgement, were of sufficient quality to meet the needs of the exercise.

All components were weighted equally. In other words, the total number of points possible for each salmonid or ecosystem component was the same. Although alternative weighting approaches are possible, ISAT felt this approach was the most appropriate and defensible at this time. To the extent that reliable scientifically-based alternatives can be developed they might be considered for inclusion in future iterations.

The weighting approach ISAT used in this iteration was not intended to suggest that all factors are likely to have the same level of influence on wild salmonids in all circumstances. Notably, the number of components differed within the salmonid (10) and ecosystem (14) categories. Thus, the ecosystem category had a greater influence on total scores, especially as related to existing relative conditions. Data were expressed in some cases as percentages or proportions to account for differences between WRIA size. In addition, in some cases, more than one component was associated with related issues. For example, multiple components relate to water, marine habitats, hatchery fish, and spawner numbers/stock status. Thus, ISAT did not intend to apply the constraint that only independent variables would be used.

Synthesis

ISAT organized all information from the salmonid population and ecosystem categories into a new X-Y coordinate system. This coordinate system, depicted conceptually in **Figure 4**, formed

the foundation of the prioritization framework. The X and Y-axes each used information from the salmonid and ecosystem categories. This approach allows visual and quantitative representation of the relationships and variations among WRIAs. The two coordinates are:

1. *Y-axis*: the relative expected efficiency and benefits to wild salmonid populations for protection and restoration activities in a WRIA, and

2. *X-axis*: the relative existing condition of wild salmonids and their ecosystems within a WRIA (emphasis shifts from restoration to protection as the quality of existing conditions increases.)

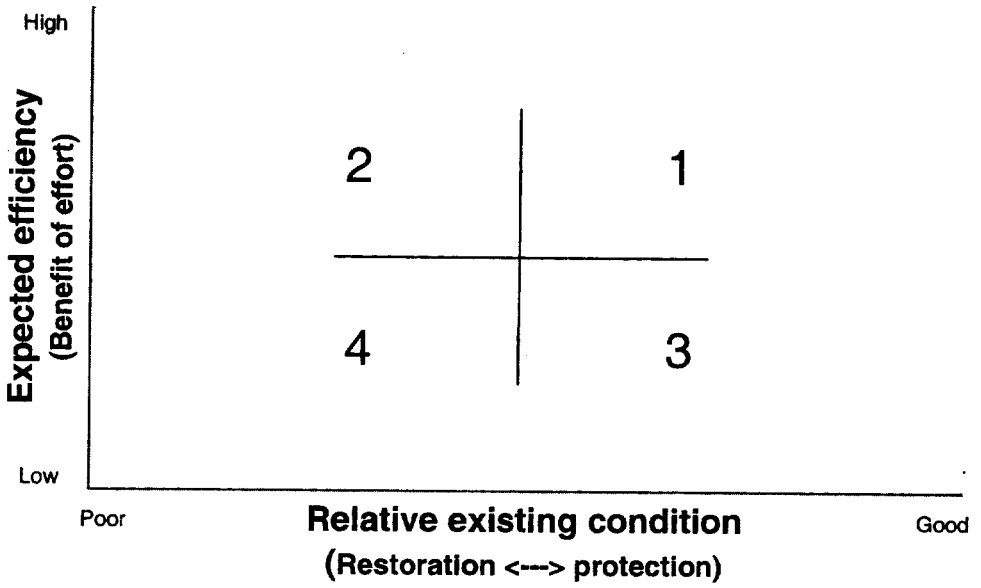

Figure 4. Conceptual diagram illustrating how composite scores for each WRIA were organized and related for visual interpretation.

Again, in **Figure 4** the Y-axis conceptually represents the relative expected efficiency and benefit of effort for recovery actions among WRIAs that would be expected to be needed to improve the general health of salmonid populations, regardless of the type of action (protection or restoration) undertaken. It does not address the needs of populations or species on an individual basis; it affords only a coarse, multispecies perspective. WRIAs that appear in the lower portions of the plot (lower Y-axis scores) would be expected to require the greatest effort for the return (lower benefit from efforts) relative to other WRIAs.

ISAT does not intend to suggest that recovery efforts would not be beneficial in WRIAs with low Y-axis scores. Low Y-axis scores simply mean that effective activities in those WRIAs would be expected to require more effort and would be expected to produce fewer benefits for similar levels of effort in comparison to WRIAs with higher Y-axis scores.

The X-axis represents the relative existing condition of salmonid stocks and their ecosystems. X-axis values are related to the expected need for restoration or protection emphasis for each WRIA. The further a WRIA is to the right on the graph (or the higher the X-axis score), the better the environment is within that WRIA and the more that efficient and effective benefits would be expected to accrue to wild salmonids through protection activities. In contrast, WRIAs with lesser quality/quantity habitat would be expected to fall to the left, and the benefits of recovery efforts in them would be expected to most efficiently and effectively emphasize restoration.

Conceptually, the distribution of WRIAs plotted on **Figure 4** can be interpreted in four quadrants or zones, although in practice the exact boundaries and position of these zones would require policy resolution. Placement of the partitions between zones must ultimately be based on policy goals, species/ESU recovery goals, implementation strategies, and other considerations. As shown conceptually in **Figure 4**:

- **Zone 1** would tend to include WRIAs that would have much to gain in terms of efficiency and benefit from conservation efforts, and in comparison to zone 2 would tend to favor protection activities.
- **Zone 2** would also have much to gain in terms of efficiency and benefit but since the starting conditions are poorer, those activities would be expected to entail more emphasis on restoration than protection.
- **Zone 3** would include WRIAs that are in relatively good condition initially, but relative to zones 1 and 2, efficiencies of activities would not be as high as in zones 1 and 2.
- **Zone 4** would contain WRIAs where efficiency is relatively low and initial conditions suggest that restoration is more likely to be more necessary and effective than protection.

One of the many challenges ISAT faced was determining what axis each component should be associated with. To address this each informational component was reviewed in detail to decide whether or not the measure best described the anticipated efficiency and benefits from efforts (Y-axis) or whether or not to relate its emphasis based on existing conditions to restoration or protection (X-axis). In many cases, the answers were clear, in others they were not. For example, in the salmonid category under the unhealthy and healthy stock information components, restoration was emphasized in WRIAs containing relatively large numbers of unhealthy stocks, whereas protection was emphasized in areas having relatively healthy stocks. Thus, information about the relative extent to which stocks within WRIAs were unhealthy (SASSI/ESA unhealthy status) was included as an X-axis variable. In contrast, protection and restoration actions are expected to be most successful at helping wild salmonid populations in the shortest possible time (efficient) where there are relatively large numbers of existing healthy stocks. Thus the informational component pertaining to stock diversity and health (SASSI/ESA healthy status) was included as a Y-axis variable. This illustrates how these two components are not simply opposites,

but instead reflect the differences in the number of stocks weighted by their condition in the various WRIAs.

In terms of information in the salmonid ecosystem category, nearshore marine condition, urbanization, and stream gradient represent good examples of components addressing the relative benefits or effectiveness of efforts. These components reflect conditions that either once degraded, are essentially not likely to change substantially in the near term or are not subject to purposeful change at all (i.e., stream gradient). Ecosystem components such as these were included as Y-axis variables. In contrast, there were components used that were deemed much more subject to change or improvement as a result of deliberate management or conservation efforts. Examples of such components include agriculture, forest condition, and migration barriers at road culverts. Thus the emphasis of these components was on restoration or protection, and they were included as X-axis variables.

Available water provides an example of a salmonid ecosystem component that ISAT recognized could be included on either the X or Y-axis. ISAT's principle of emphasizing protection efforts where ecosystems/salmonids are healthiest would suggest that areas where water is available for salmonids should be protected and where it is inadequate, restoration efforts should be emphasized. However, ISAT also recognized that without adequate water flow, other habitat efforts will not be effective at producing benefits for wild salmonids. This would argue for including the measure of adequate water as a Y-axis variable.

ISAT felt that use of an X-Y coordinate system would provide a useful framework to identify WRIAs wherein recovery efforts would benefit the most salmonids to the greatest extent, in the shortest possible time.

Information resulting from this prioritization exercise were organized to allow use at three hierarchical spatial scales or different scales of interest, including:

- broad overview of WRIAs across all of western Washington,
- examination of characteristics and patterns between groups of WRIAs comprising the three salmon recovery regions in western Washington, and
- comparison of WRIAs within the ESA recovery regions.

A stepwise approach was used to identify priorities in western Washington. First, ISAT ranked WRIAs according to their respective combined Y-axis scores. This provided a ranked list of WRIAs indicating where the greatest benefits for wild salmonids might be expected for the least effort and in the shortest possible time. Second, the extent to which expected benefits might be associated with protection and/or restoration efforts was interpreted from the position of each WRIA along the X-axis. This was done by determining the Y-axis mid-line among the spread of WRIA points. Points falling to its left were identified as needing restoration emphasis whereas points to its right were identified as needing protection emphasis. Points close to the line were identified for both protection and restoration, indicated by a leading P or R depending on which the side of the line the point occurred.

Table 1. Informational components (from outline above) on X (existing relative condition) and Y (relative benefit or effectiveness) axes. *Components in italics were not included in this analysis, but are high priority needs for future iterations if suitable data are available for the study area. See Appendix 1 for a description of these components.*

Existing relative condition (X-axis)	**Relative benefit or effectiveness** (Y-axis)
Salmonid components	**Salmonid components**
Unhealthy stocks and ESUs at-risk	Healthy stocks and ESUs not at-risk
Genetic diversity	Stock origin
Spawner numbers	Production type of natural spawners
	Overfished stocks
Ecosystem components	Hatchery fish identification
Forage fish	Natural production
Human population growth	Hatchery-natural ratio
Water quality	*Ecological interactions*
Percentage of land in agricultural use	*Fish health management*
Forest seral stage along streams	
Impervious surfaces - road density	**Ecosystem components**
Fish passage - culverts	Estuary development
Water availability for fish	Nearshore marine condition
Extent of protected lands	Percentage of urban development
Salmonid strongholds	Channel gradient (productivity)
	Hydrologic modification (dams)
	Frequency of peak flows
	Low flow constraints
	Aquatic biodiversity

Results

The results of this prioritization exercise are geographically (WRIA) based, and identify both high and low priority WRIAs for recovery efforts. However, ISAT feels that all WRIAs in the study area should be recognized as containing valuable habitats and components of diverse salmonid species and life histories. Readers should guard against falsely concluding that some WRIAs are important while others are not. This ranking exercise merely provides guidance on how best to direct attention and emphasis among WRIAs at this point in time. As conditions change, results from a reanalysis would also be expected to change. To maintain and restore salmonids it will be important to recognize goals for recovery, and to integrate a geographical approach with a phased approach that deliberately distributes resources in time as well as geographically. Temporal considerations were not directly addressed in this framework. Recovery goals were not available.

As noted above, WRIA results were interpreted at three geographic scales: across western Washington, between salmon recovery regions, and WRIAs within regions.

Priority WRIAs across Western Washington

The quantitative results of this analysis are provided graphically and tabularly. **Figure 5** depicts the composite of scores for western Washington WRIAs plotted as X-Y coordinates. A summary table including information and scores for each component and data set is found in **Appendix 3**.

CAUTION: Due to the coarse nature of the methodology used to prioritize WRIAs, conclusions associated with relationships among WRIAs and their rankings should be interpreted with caution. Readers are strongly urged to consider the following (see also page 27):

1. ***The greater the distance between points of interest (WRIAs), the greater the confidence that actual differences exist, and***
2. ***As the distance between points of interest decreases, the likelihood of actual differences also decreases.***

Figure 5 depicts scores from each WRIA distributed along the X and Y-axes. Recall that the X-axis is a *relative* index of the existing salmonid and ecosystem conditions potentially affecting wild salmonids, and the Y-axis is a *relative* index of the relative efficiency or benefits to wild salmonids from a similar level of effort. WRIAs further to the right on the X-axis (e.g., Upper Skagit WRIA 4) have better initial conditions than do WRIAs to the left (e.g., Chambers-Clover WRIA 12). In general, a potentially useful way to look at the X-axis is to consider WRIAs further to the right as meriting protecting due to their relatively high quality/quantity conditions, and WRIAs to the left as having poorer conditions that may require more emphasis on restoration compared to protection. WRIAs higher on the Y-axis (e.g., Queets-Quinault WRIA 21) would be expected to

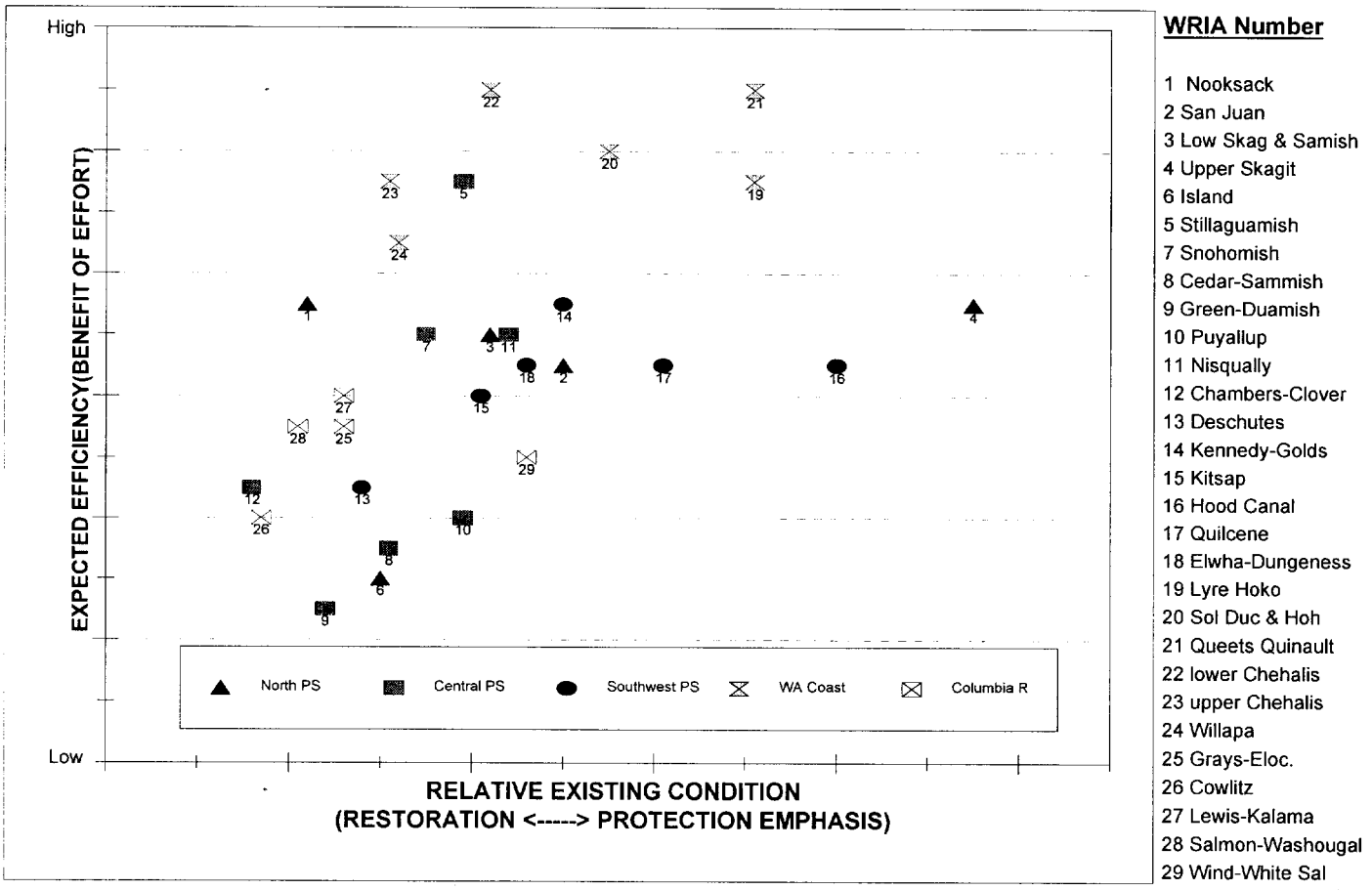

Figure 5. Composite scores for salmonid and ecosystem information for each WRIA in western Washington, showing relationships associated with the expected efficiency and benefits of recovery efforts (Y-axis) and the relative existing condition (protection and/or restoration emphasis)(X-axis).

benefit more from a given level of effort (expressed in fiscal or other currencies of effort) than WRIAs lower on the Y-axis (e.g., Green-Duwamish WRIA 9).

The distribution of points in **Figure 5** reflects the wide diversity of conditions and circumstances representing and affecting salmonids and their habitats among and within WRIAs in western Washington.

A ranked listing of WRIAs according to Y-axis scores (**Appendix 3**) is provided below in **Table 1**. Where Y-axis scores were the same, WRIAs were included in the same rank. The highest scores represent those WRIAs in which conservation and recovery efforts would be expected to have the greatest efficiency and benefit for salmonids in the shortest possible time. The table also includes a column indicating whether recovery efforts in each WRIA would be expected to emphasize protection or restoration activities. Protection or restoration emphasis is based on inspection of the X-axis in **Figure 5.**

When viewing X-axis scores of WRIAs across western Washington, **Figure 5** reveals that recovery efforts in the top tier (top 33% of WRIAs based on highest Y-axis scores), typically emphasize protection. When WRIAs in **Table 1** and **Figure 5** are viewed in three equal sized tiers or groups of WRIAs (about ten WRIAs each), viewed from top to bottom, the distribution WRIAs tends to move from protection to restoration emphasis.

Patterns between regions

To help identify patterns in the distribution of WRIA scores among regions, WRIAs in **Figure 5** are indicated by different symbols associated with each of the three different regions (Puget Sound, Washington Coast, Lower Columbia River). Inspection of this figure identifies general patterns among regions. A wider range of variation appeared to occur among the large number (WRIAs 1-18) of WRIAs in the Puget Sound region compared to WRIAs in other two regions. The second tier (33-66% of WRIAs) of Y-axis scores (**Table 1**) contained most Puget Sound WRIAs. Also, a large percentage (over 80%) of Puget Sound WRIAs were on the restoration (left) side along the X-axis. Most of the WRIAs having the highest quality environments and the most numerous stocks and diversity were located in the Washington Coastal (WRIAs 19-23) and Southwest Puget Sound regions (WRIAs 13-18), each in which emphasis in half of the WRIAs was on protection. In contrast, environments of the five WRIAs in the Lower Columbia River region (WRIAs 25-29) and the seven WRIAs in the Central Puget Sound (WRIAs 5, 7-12) were of lesser quality (lower X-axis scores). These WRIAs were generally found in the bottom of the second and in the third tier in **Table 1.** Compared to the other WRIAs in western Washington, the WRIAs essentially all had scores suggesting restoration should be emphasized. More detail is presented below on each region.

Patterns within regions

The interpretation presented above resulted from a broad view of WRIA information across western Washington. This section will explore patterns within each of the three major regions

(Puget Sound, Washington Coast, Lower Columbia River). It will also include a review of the three subregions in the Puget Sound region.

Table 1. Summary indicating the relative expected benefit and effectiveness of conservation actions for wild salmonids (combined Y-axis scores for all components) in the 29 western Washington. Protection (P) and/or restoration (R) were interpreted from Figure 5. Y-axis scores are from Appendix 3.

Rank	WRIA number/name	Y-axis score	Protection (P) and/or restoration (R) emphasis
1	21 Queets-Quinault	110	P
	22 Lower Chehalis	110	R
2	20 Sol Duc - Hoh	100	P/R
3	19 Lyre - Hoko	95	P
	5 Stillaguamish	95	R
	23 Upper Chehalis	95	R
4	24 Willapa	85	R
5	4 Upper Skagit	75	P
	14 Kennedy-Goldsborough	75	R/P
	1 Nooksack	75	R
6	11 Nisqually	70	R
	3 Lower Skagit-Samish	70	R
	7 Snohomish	70	R
7	16 Hood Canal	65	P
	17 Quilcene	65	P/R
	2 San Juan[4]	65	R/P
	18 Elwha-Dungeness	65	R/P
8	15 Kitsap	60	R
	27 Lewis-Kalama	60	R
9	25 Grays-Elochoman	55	R
	28 Salmon-Washougal	55	R
10	29 Wind-White Salmon	50	R/P
11	13 Deschutes	45	R
	12 Chambers-Clover	45	R
12	10 Puyallup	40	R
	26 Cowlitz	40	R
13	8 Cedar-Sammamish	35	R
14	6 Island[4]	30	R
15	9 Green-Duwamish	25	R

[4] These WRIAs are not home areas for salmonids of concern. The WRIAs were included however, because they are part of and can influence the larger ecosystem some salmonids use during the marine phases of their life cycles.

As cautioned previously, the greater the distance between points of interest, the greater the confidence that an actual difference occurred. As distances between points of interest decrease, the likelihood of actual differences also decreases. Readers should inspect variation in Y-axis scores at each scale of interest to ascertain the extent to which each point or group of points is different from the others within that scale.

Puget Sound

The Puget Sound region is comprised of the largest number of WRIAs (18) in western Washington (**Table 2**). For the purposes of this exercise, information was reviewed to discern general patterns within this broad region as well as those that may be apparent within its three "subregions" (North, Central, Southwest). *Note - ISAT recognizes subregional boundary delineations are not completely resolved. For present purposes the Puget Sound subregions were anchored by the Tri-County area, which includes Snohomish, King, and Pierce counties. That area was the Puget Sound Central subregion. Seven WRIAs were included in that subregion (WRIA# 5, 7, 8, 9, 10, 11, 12). In general, the areas north of Snohomish County and south of Pierce County were deemed to be the North (n = 5; WRIA# 1, 2, 3, 4, 6), and Southwest (n = 6; WRIA# 13, 14, 15, 16, 17, 18) subregions, respectively. The Upper Skagit and Stillaguamish WRIAs to the north, and the Nisqually WRIA to the south, share some of their watershed areas with the Central subregion.*

Review of Y-axis scores shows considerable variation (70) between WRIAs in Puget Sound. The top tier (top 33%) of Y-axis scores were primarily from the north and central parts of Puget Sound. With a few fairly clear exceptions (e.g., WRIAs 4, 16) benefits in most WRIAs in Puget Sound would be expected to accrue from an emphasis on restoration.

Based on the distribution of Y-axis scores, WRIA 5 (Stillaguamish) appears to stand out as the highest priority WRIA in Puget Sound in terms of expected efficiency and benefit of recovery actions. **Table 2** suggests a restoration emphasis in over 80% of the WRIAs in the Puget Sound region.

Within Puget Sound subregions

As shown in **Figure 3** and **Table 3**, the range of variation in Y-axis scores for WRIAs in North Puget Sound was intermediate (45) to that of the Central (70) and Southwest (30) subregions. As noted earlier, WRIA 5 (Stillaguamish) is fairly well separated from the other WRIAs in the Central subregion, and is quite distinct from WRIAs 8 and 9 (Cedar-Sammamish and Green-Duwamish, respectively). Variation among WRIAs within the Southwest subregion was relatively small, with WRIA 13 (Deschutes) being most clearly distinguishable from the other WRIAs in that subregion.

Table 2. Summary indicating the relative expected benefit and effectiveness of conservation actions for wild salmonids (combined Y-axis scores for all components) in the 18 WRIAs in the Puget Sound region. Information on rank, Y-axis scores, and protection (P) and/or restoration (R) emphasis is from Table 1.

Rank	WRIA number/name	Y-axis score	Protection (P) and/or restoration (R) emphasis
1	5 Stillaguamish	95	R
2	4 Upper Skagit	75	P
	14 Kennedy-Goldsborough	75	R/P
	1 Nooksack	75	R
3	11 Nisqually	70	R
	3 Lower Skagit-Samish	70	R
	7 Snohomish	70	R
4	16 Hood Canal	65	P
	17 Quilcene	65	P/R
	2 San Juan	65	R/P
	18 Elwha-Dungeness	65	R/P
5	15 Kitsap	60	R
6	13 Deschutes	45	R
	12 Chambers-Clover	45	R
7	10 Puyallup	40	R
8	8 Cedar-Sammamish	35	R
9	6 Island	30	R
10	9 Green-Duwamish	25	R

Table 3. Summary of the three Puget Sound subregions indicating the relative expected benefit and effectiveness of conservation actions for wild salmonids (combined Y-axis scores for all components). Information on rank, protection (P) and/or restoration (R) emphasis is from Table 1.

North			Central			Southwest		
WRIA#	Y-axis	P-R	WRIA#	Y-axis	P-R	WRIA#	Y-axis	P-R
1 Nooksack	75	R	5 Stillaguamish	95	R	14 Kennedy-Golds.	75	R/P
4 Upper Skagit	75	P	11Nisqually	70	R	16 Hood Canal	65	R/P
3 Lower Skag.-Sam.	70	P	7 Snohomish	70	R	17 Quilcene	65	P/R
2 San Juan	65	R/P	12 Chambers-Clover	45	R	18 Elwha-Dungeness	65	P
6 Island	30	R	10 Puyallup	40	R	15 Kitsap	60	R
			8 Cedar-Sammamish	35	R	13 Deschutes	45	R
			9 Green-Duwamish	25	R			

Washington Coast

Compared to other regions in western Washington, variation among Y-axis scores within the Coastal region was relatively small (25), indicating a relative similarity among salmonid and ecosystem features within this region. As noted previously, compared to other regions, WRIAs in the Coastal region generally contain salmonid populations and habitats with fairly good existing conditions. In addition, recovery actions might be expected to have the greatest benefit for salmonids with the least effort, in the shortest possible time in these WRIAs. An emphasis on protection is indicated in half of the WRIAs. WRIAs in this region tended to contain more high Y-axis scores than any other in western Washington.

Table 4. Summary indicating the relative expected benefit and effectiveness of conservation actions for wild salmonids (based on combined Y-axis scores for all components) in the 6 WRIAs in the Washington Coast region. Information on rank, Y-axis scores, and protection (P) and/or restoration (R) emphasis is from Table 1.

Rank	WRIA number/name	Y-axis score	Protection (P) and/or restoration (R) emphasis
1	21 Queets-Quinault	110	P
	22 Lower Chehalis	110	R
2	20 Sol Duc-Hoh	100	P/R
3	19 Lyre-Hoko	95	P
	23 Upper Chehalis	95	R
4	24 Willapa	85	R

Lower Columbia River

Y-axis scores between WRIAs within the Lower Columbia region varied the least (20) of any region in western Washington, reflecting a general similarity of the salmonid and ecosystem features within this region. In addition, the highest Y-axis scores for WRIAs in this region were lower than those for other regions, suggesting that the efficiencies and benefits from recovery actions generally might be less in this region compared to the others. Put another way, more effort/resources will be needed to achieve a similar level of recovery. An emphasis on restoration was noted for all WRIAs the Lower Columbia region, with the possible exception of WRIA 29 (Wind-White Salmon) in which relative protection emphasis was greatest.

Table 5. Summary indicating the relative expected benefit and effectiveness of conservation actions for wild salmonids (based on combined Y-axis scores from all components) in the 5 WRIAs in the Lower Columbia region. Information on rank, Y-axis scores, and protection (P) and/or restoration (R) is from Table 1.

Rank	WRIA number/name	Y-axis score	Protection (P) and/or restoration (R) emphasis
1	27 Lewis-Kalama	60	R
2	25 Grays-Elochoman	55	R
	28 Salmon-Washougal	55	R
3	29 Wind-White Salmon	50	R/P
4	26 Cowlitz	40	R

Summary and Recommendations

A cautionary reminder

The prioritization framework and analysis provided here are intended to extend the scientific underpinnings of the initial effort outlined in the Draft Statewide Salmon Recovery Strategy, with emphasis on recovery efforts aimed toward improving habitat for wild salmonids in western Washington. The results of this exercise are geographically based (WRIA), and identify a range of priority WRIAs for recovery efforts. All results comparing WRIAs against each other should be considered in relative terms. There are no absolutes.

The system described here illustrates one approach, but others are possible, depending on policy overlays, alternative analytical and weighting schemes, and use of information that was unavailable to ISAT.

As stated previously, ISAT feels strongly that all WRIAs in the study area should be recognized as containing valuable habitats and components of salmonid species and life history diversity. While some habitats may be of only marginal quality, such habitats can be important for the full expression of life history diversity and productivity in salmonid species. It is risky to assume that some WRIAs are valuable while others are not. This ranking exercise merely provides guidance on where protection and restoration attention and emphasis might be directed among WRIAs at this point in time. To protect and restore salmonids efficiently and effectively it will be important to have clear recovery goals and objectives for species/ESUs and habitats, and to integrate geographical approaches with plans that deliberately distribute resources in time as well as in space (e.g., within and across project sites, watersheds, regions).

Summary comments

The prioritization framework presented here was developed to meet a specific assignment from the Joint Natural Resources Cabinet. This framework extends that provided in the draft Statewide Salmon Recovery Strategy by bolstering incorporation of scientific principles and including additional information categories and components.

Given the caveats previously noted, this framework leads ISAT to offer the following generalizations about expected efficiencies, effectiveness, and types of efforts that might be undertaken in western Washington:

- Recovery efforts directed at the Coastal region (19-24), and Stillaguamish (5) WRIAs would generally be expected to produce the greatest efficiency and benefits to wild salmonids.

- In contrast, the efficiency and benefit of recovery efforts directed at WRIAs 9 (Green-Duwamish), 8 (Cedar-Sammamish), 10 (Puyallup), 26 (Cowlitz) would be expected to be lowest. (Note WRIA 6-Island is also included in this group but has relatively limited influence on salmonid and ecosystem values.)

- There are few WRIAs with relatively good existing conditions, whose benefits from recovery efforts would be expected to accrue from an emphasis on protection. These few include WRIA 4 (Upper Skagit), 16 (Hood Canal), 19 (Lyre-Hoko), and 21 (Queets-Quinault).

- In contrast, there are many WRIAs with poorer conditions in which the most beneficial results from recovery efforts would accrue from an emphasis on restoration. Importantly however, in less than half of these WRIAs would efficiency and benefits be expected to be high relative to other WRIAs. WRIAs in which efficiencies and benefits from an emphasis on restoration would be expected to be highest include WRIA 3 (Lower Skagit-Samish), 11 (Nisqually), 7 (Snohomish), 1 (Nooksack), and 14 (Kennedy-Goldsborough).

How to interpret this information

Summary tables and figures are provided that characterize the relative priority of WRIAs at multiple spatial scales of potential interest to meet the general goals of efficiency and effectiveness. It is important to reiterate that these goals DO NOT represent specific responses to listings or proposed listings under the ESA.

The Y-axis represents the sum of factors that ISAT used to depict the anticipated response of wild salmonids to protection and restoration efforts. Based on the ecosystem condition of WRIAs and the health and diversity of salmonid populations within them, ISAT expects different levels of salmonid response will occur from a given level of conservation effort.

A general approach for use of these tables to identify specific priority WRIAs in a coarse manner would be to:

1. view those WRIAs with the highest Y-axis scores as being in the highest priority tier. WRIAs in that tier might be expected to produce the greatest efficiencies and expected benefits to wild salmonids in the shortest possible time, and then
2. inspect the associated tables and figures to ascertain whether that WRIA might best receive protection and/or restoration emphasis.

Another way to view the Y-axis is that to achieve a similar level of recovery, much more effort will be required in those WRIAs with low Y-axis scores. Availability of technical and policy goals pertaining to how much recovery is desired, in what areas, and over what time frames, should help determine whether a "triage" approach is needed. It was not ISAT's intent for readers to interpret the Y-axis scores merely as recommendations related to the amount of money or other resources that should be spent among WRIAs, or that recovery efforts are not needed in some WRIAs (e.g., triage, because either they are not worth the effort or effort would be relatively unproductive compared to other areas [low Y-axis score]; or they do not need recovery attention

[high Y-axis score]). Those judgements must await technical and policy responses once specific species/ESU recovery goals are available.

Until policy and recovery goals are better clarified, it will likely be argued that most fiscal or other effort should be directed to one of two alternatives. One is that effort should be directed to WRIAs with low Y-axis scores to get them up to a certain base level of recovery; the other is to put most of the available resources into WRIAs with high Y-axis scores where the most efficient and immediate responses would be expected (i.e., triage). Again, sorting among these options will be most meaningful once clearly articulated recovery goals are available. ISAT generally expects that a diversity of healthy salmonid populations will be needed for recovery of salmonids within regions. The purpose of the Y-axis is to indicate the variability in expected responses so that reasonable policy and management decisions and expectations can be pursued.

It is important to distinguish between this scientific framework and the policy and management decisions that remain to be made to use the information in prioritizing actions. ISAT's work provides technical information supportive to decisions associated with policy priorities for recovery activities and expenditures. It is not ISAT's charge to make those decisions. Decision makers must contend with how to resolve species and policy goals, risks, and other social, economic, and other considerations. It is hard to imagine that resources will ever be sufficient to address all the needs that exist in all WRIAs. Hard allocation decisions appear inevitable.

Again, ISAT understand determination of allocation thresholds is a policy and administrative issue, not a scientific one. The draft SSRS outlined an allocation scheme whereby 20% of the available resources would be distributed broadly across all WRIAs, and of the remaining 80%, 60% would be allocated to protection and 40% would be allocated to restoration. The results of ISAT's prioritization scheme could be used to provide guidance within those or other allocation parameters.

Implementation context

ISAT developed this prioritization framework by identifying and using only information on salmonids and their ecosystems that met stated criteria for inclusion. In addition to that information however, ISAT strongly advises that another category of information - **implementation context** - be used to make prioritization decisions. This could be one of the key policy overlays imposed on the available scientific information.

ISAT felt the extent to which commitments to salmonid and ecosystem resources are actively demonstrated and ready to proceed should be assessed for each WRIA. WRIAs that have functional planning and implementation management structures and processes that are more advanced and coordinated in addressing all factors affecting production, would be expected to have the best chance of contributing the most immediate and substantial benefits from new habitat protection and/or restoration efforts, all else being equal.

ISAT identified overarching concerns and assumptions that could be addressed in considering implementation of a prioritization system, including:

- human population growth will occur at a rapid pace into the future,
- given the increase in human population pressure, human behavior and institutional mechanisms will lead to sufficient numbers of spawning fish to support human needs and ecosystem functions, and
- focused and organized strategies and plans will provide reasonable and successful recovery approaches.

It is not clear whether these assumptions will prove correct, but their implications should be considered if recovery if populations of salmonids are to viable and sustainable over the long term.

ISAT recommends that a complementary scoring system be developed as a final filter of ISAT's prioritization output at the desired WRIA/regional scale(s) of interest. Assessments of adequacy or extent could be made for the list below, whether effectively planned (e.g., receiving some level of positive score) or implemented (e.g., receiving higher positive scores), and integrated across the multiple jurisdictions operating within salmonid ecosystems (e.g., local, state, federal). The following types of information might be used:

- Existence of functional watershed and regional scale conservation/recovery governance structure(s).
- Projections of human population growth and related demands on watersheds.
- Occurrence and degree of completion/implementation of species/comprehensive conservation or recovery plans, HCPs, landscape plans, watershed management plans, etc.
- Adequacy of fish-friendly dam/hydro operations.
- Provision of instream flows at the right times and in the right places.
- Extent of fish passage improvement plans and implementation (small and large obstructions).
- Adequacy of growth management plans and compliance (e.g., shorelines management plans, stormwater ordinances, critical areas).
- Adequacy of fishery harvest management plans/agreements exist that meet human as well as ecosystem needs.
- Adequacy of hatchery management reforms to address risks while achieving benefits.
- Adequacy of agricultural plans/practices.
- Adequacy of forest practices.
- Adequacy of information/data on watershed condition (structure, function, dynamics)
- Existence of functional monitoring, evaluation, data collection, and adaptive management frameworks.

Final comments about protection vs. restoration

ISAT does not feel that each WRIA should be strictly considered for either protection or restoration since a wide range of conditions and circumstances exist within each WRIA. Within each WRIA it is highly likely that protection and restoration needs will be identified. Analyses and assessments of conditions within watersheds and for individual salmonid species and stocks will

have the greatest power in directing resources to restoration and/or protection activities within WRIAs. However, the framework provided here reflects a coarse, multispecies, and timely approach that should help guide the type and extent of effort and/or resources to activities on the ground.

Scientific principles call for emphasis on conservation and restoration of habitat structure (e.g., native diversity of ecosystems), function (e.g., ecosystem productivity, hydrology, trophic structure, and transport)(Williams et al. 1997), and habitat-forming processes (Beechie and Bolton 1999). The emphasis of efficient and effective conservation and recovery efforts should address the causes of degradation, not the symptoms.

The objective of this exercise was not just to identify the WRIAs in which efforts would be expected to be most efficient and beneficial, but to attempt to distinguish among WRIAs whose efficient benefits would be achieved from protection or restoration emphasis. The identification of areas for protection emphasis is a fundamental part of conservation and recovery planning strategies for many species. Protection emphasis can be manifested in many ways. For example, protection designations can be formalized from designation and focused management of critical areas (e.g., via WDFW Priority Habitats and Species; Growth Management Act), riparian reserves (e.g., CREP, Northwest Forest Plan Aquatic Conservation Strategy (FEMAT 1993)), "key watersheds" (e.g., Northwest Forest Plan (FEMAT 1993)), fish refugia or sanctuaries (e.g., Sedell et al. 1990; Moyle and Yoshiyama 1994; Li et al. 1995; Rahr et al. 1998), and enforcement emphasis complementary to all of the above. Many other examples could be identified to help illustrate strategies geared toward protection.

However, it is important to stress that the distinction between protection and restoration emphasis is relative. It would be hard to find a watershed or ecosystem in western Washington that has not been affected to some extent by human activities. Thus, complementary restoration of ecosystem structure and function may indeed need to be considered in WRIAs where protection is emphasized, and it will be imperative to protect features and investments once restored if positive results are to be sustained over the long term. Moreover, within WRIAs in which restoration emphasis was identified (i.e., relatively poor existing conditions), it is likely that there are areas or pockets of high quality habitat for which protection strategies would be expected to provide efficient and effective benefits, if pursued in an ecosystem context.

Suggestions for future iterations

While ISAT feels this prioritization system and analysis represent substantial improvement over the methodology outlined in the draft SSRS, additional improvements can always be identified. Various enhancements could be performed to improve the approach in subsequent iterations. Suggestions for future iterative improvements should be targeted on the data and/or analysis needs expected to have the greatest impact on meeting stated objectives. At this time ISAT suggests the following priority enhancements to this process (not in priority order):

- A fundamental need exists to better define and incorporate recovery goals regarding desired future conditions for wild salmonid populations and their habitats at appropriate

spatiotemporal scales. Such information will allow a much improved and focused prioritization scheme.

- Develop and utilize a GIS-based approach and tools (e.g., Lunetta et al. (1997)).
- Identify/incorporate new data (e.g., ecological interactions/fish health; hydrograph/low info; strongholds; aquatic biodiversity metrics).
- Consider more explicit means to express and incorporate capacity for improvement in habitat and wild salmonid status.
- Improve/update databases used (e.g., SASSI/SaSI; human population growth) to reduce or eliminate data gaps.
- Review alternative scoring/weighting schemes (current emphasis on ecosystem components).
- Develop adequate information to perform analyses at finer scales of resolution (e.g., Watershed Administrative Units (WAUs)) rather than WRIAs.