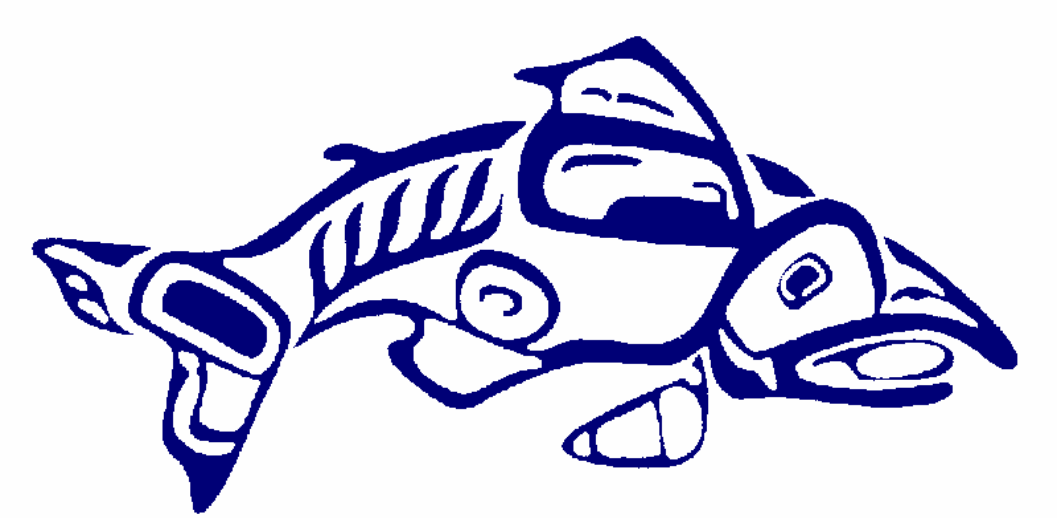
Landscape Assessment and Conservation Prioritization of Freshwater and Nearshore Salmonid Habitat in Kitsap County



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Prepared for Kitsap County

2003 KITSAP SALMONID REFUGIA REPORT

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- David Nash, Kitsap County DCD GIS analyst, contributed data and technical assistance.
- Dave Christensen, Jefferson County Natural Resources Division, project manager for the East Jefferson Refugia Study, contributed significantly to the final report.
- Keith Folkerts, Kitsap County DCD, was the Project Manager and author of Executive Summary.

EXECUTIVE SUMMARY

The goal of this project is to *identify* and *characterize* potential salmonid conservation and restoration areas located within Kitsap County. After identification of these areas, a primary objective of this project was to analyze and prioritize these *salmonid refugia* to assist in conservation, enhancement, and restoration efforts. A major aim of the project is to support the early salmon recovery actions necessary to preserve the remaining areas of high-quality salmonid spawning and rearing habitat in the region. Protection of these "last best places" is likely an essential part of the salmon recovery process, but alone will not be sufficient to ensure the restoration of natural runs of native salmonids.

Definition of Salmonid Refugia

"Salmonid" means "of the salmon family." Salmonids in the study area include coho, chum, chinook, and pink salmon, as well as steelhead and cutthroat trout. This report is based upon a multi-species approach and does not give special consideration to any individual species of salmon.

One ecological definition of *refugia* is an area where special environmental circumstances have enabled a species or community of species to survive after decline or extinction in surrounding areas. For the purpose of this report, *salmonid refugia* can be defined as "habitats or environmental factors that provide spatial and temporal resistance and/or resilience to aquatic communities impacted by natural and anthropogenic disturbances"

Refugia can be stream corridors, watersheds, or shoreline areas. No single factor leads an area to be designated as refugia, rather it is a convergence of several ecological (physical and biological) factors.

Areas that qualify as *refugia* typically have habitat features such as intact streamside forests, undeveloped floodplains, wetlands, and natural shorelines. Refugia are used intensively by salmon compared to non-refugia areas—they are biological "hot-spots."

Refugia areas are important for maintaining *populations* of salmon. Refugia act to "re-seed" nearby areas after natural or man-made disturbances. Figure ES-1 shows how a "core population" on the mainstem of a river can be a source for naturally re-stocking outlying populations. For wild salmon to continue to survive, these core populations (and their habitat) must remain viable. It is from these core populations found in refugia areas that salmon populations will recover and begin to use less ideal habitat, forming "satellite populations."

The refugia concept is similar to the thinking that led to the formation of the National Wildlife Refuge System. Migratory waterfowl and other wildlife benefited and thrived during the last century because key habitat was protected.

Refugia areas are not only important for salmon but also for other wildlife and plant communities.

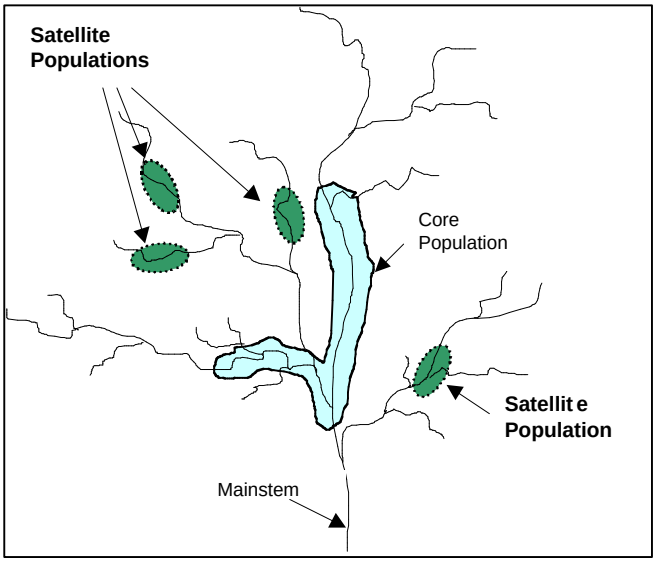

Figure ES-1: Refugia concept showing core populations and satellite populations.

Why was this study undertaken?

This study was undertaken because refugia are critical for wild salmon to survive and funds to recover salmon are limited. One of the first crucial steps to cost-effectively maintain or restore wild salmon populations is to identify areas that are critical for wild salmon. This study, in conjunction with more detailed Limiting Factors Analyses, comprise the initial steps in a comprehensive, long-term salmon recovery process.

Refugia areas identification and categorization process

To determine if a watershed, stream corridor, or marine shoreline is a refugia area, the study looked at several "landscape-centered" factors and several "fish-centered" factors. Examples of "landscape-centered" data used:

- LandSat images showing watershed conditions such as the amount of development and forest cover.
- LandSat images showing the amount and quality of streamside forests and floodplain development.
- Nearshore marine conditions such as bulkheads and presence of eelgrass.

Examples of "fish-centered" data used:

- Records related to salmon presence, abundance, diversity, and productivity.
- Field data about the condition of instream habitat (such as the amount of large woody debris, the quality of spawning gravels, and the stability of streambeds).

Figure ES-2 shows how the freshwater refugia scores were determined. Since some factors are more important than others, each factor (top line of boxes) was given a certain "weight" (depicted by the pie charts in the middle of the graphic) before incorporating it into a "fish score," a "watershed score," and a "riparian score." These three scores were combined to come up with a "final score." Based upon each refugia's final score (and interjecting best professional judgment to make modifications as necessary) the author assigned a category to each refugia. A similar process was used to categorize shoreline refugia (see ES-3).

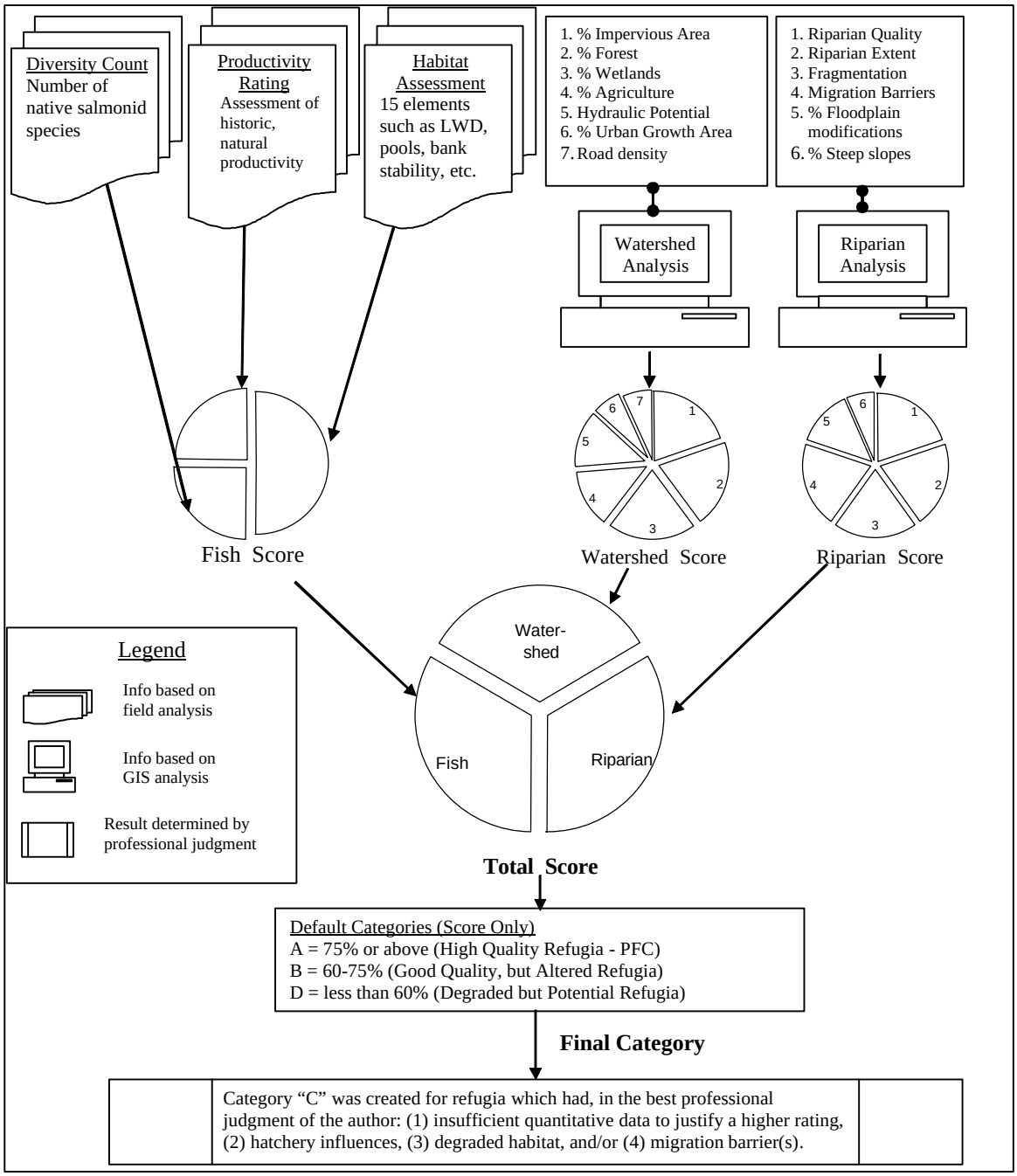

Figure ES-2: Freshwater Refugia Scoring and Categorization Process.

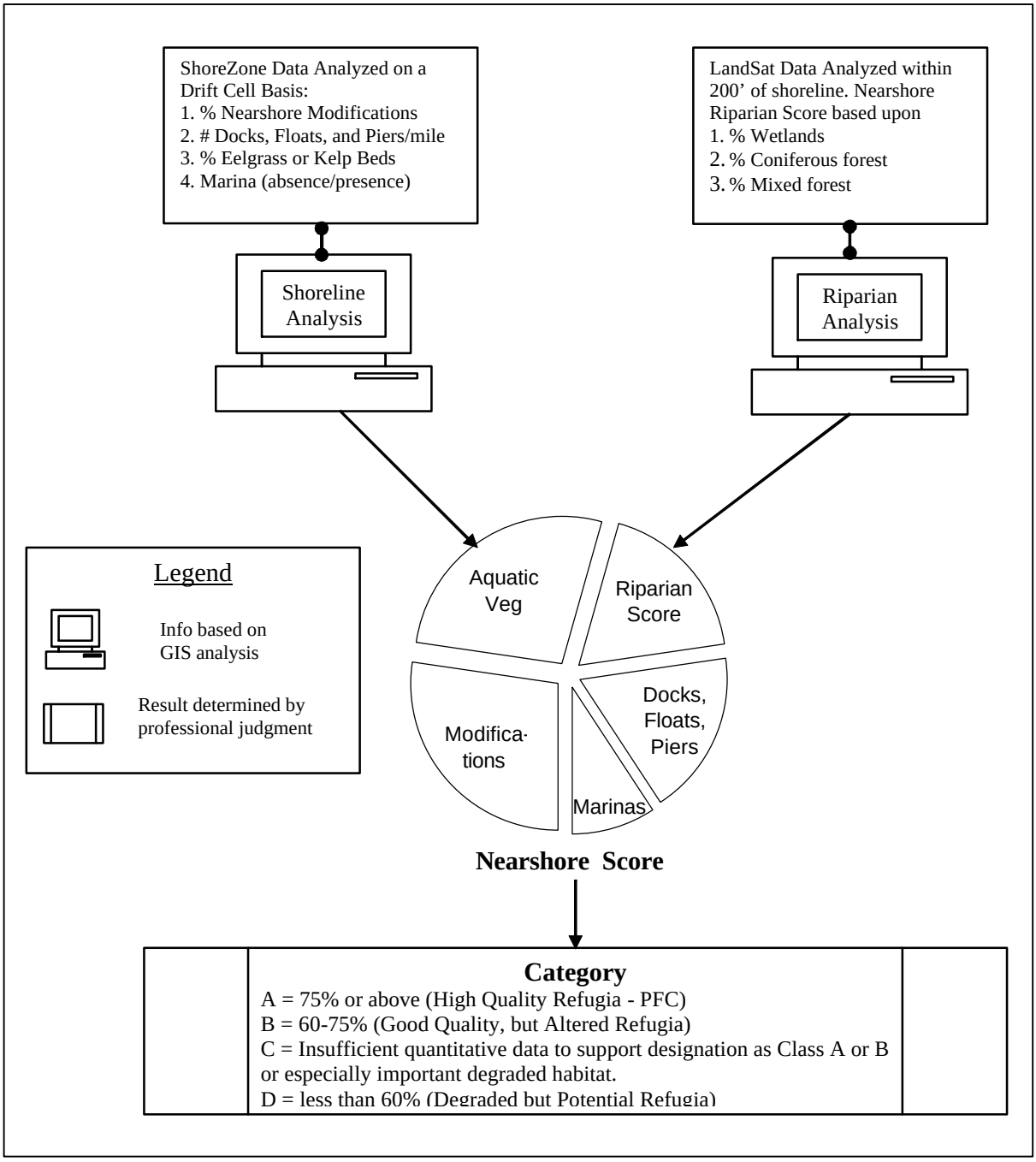

Figure ES-3: Nearshore and Estuarine Refugia Scoring and Categorization Process.

Definition of Refugia Categories

Category "A" means: "Priority refugia with natural ecological integrity." While not necessarily pristine, these areas are nearly intact, relatively undisturbed, and generally exhibit *properly functioning conditions*. These are generally in excellent condition.

Category "B" means: Primary refugia with altered ecological conditions." These are refugia with somewhat disturbed conditions, but which still support natural assemblages of native salmon. These are generally in good condition.

Category "C" means: "Secondary refugia with altered ecological integrity." These areas may belong in Category "A" or "B" if not for hatchery influences, migration barriers and/or degraded habitat. These are generally in fair condition. The author also placed in this category refugia that did not support a higher rating due to a lack of quantitative data. This could be called "Possible refugia."

Category "D" means: "Potential refugia with altered ecological integrity." These areas are best described as "potential future refugia" due to significantly degraded habitat conditions. These areas were likely historically important for salmon, but today do not support anywhere near natural levels of salmon productivity.

Areas that did not meet these criteria were considered non-refugia.

Stavis Creek Estuary. Stavis Watershed is watershed with the highest score in the study area.

The Lower Reach of the Dewatto River is the stream reach with the highest score (88%). It is part of a Category A Focal Sub-Watershed Refugia.

The South Fork of Dogfish Creek is the stream reach with the lowest score (37%). It is designated as a Category D Nodal Riparian Corridor refugia.

The Point No Point nearshore is the shoreline with the highest Nearshore-Estuarine score (83%). It is designated as a Category A Nearshore-Estuarine Refugia.

Sinclair Inlet is the shoreline with the lowest Nearshore-Estuarine score (19%). It is designated as a Category D Nearshore-Estuarine Refugia.

Types of Refugia

The report delineates freshwater refugia as one of two types: (1) "Focal Sub-Watershed" (FSW); or (2) "Nodal-Riparian Corridor" (NRC). Generally, a "Focal Sub-Watershed" designation is more appropriate for headwater areas, while a "Nodal-Riparian Corridor" designation is more appropriate for lower reaches of a stream, or streams that are confined within steep-sloped valleys. One type is not necessarily "better" than the other; it is more a matter of which type of refugia fits the specific situation in the field and which type will be more effective for conserving salmon habitat.

For marine areas, the report delineates "Nearshore and Estuarine" (NSE) refugia for those stream estuaries, nearshore migration corridors, and shoreline areas that provide refuge habitat for migrating and rearing salmon. Nearshore and Estuarine refugia are based upon *drift cells*. Drift cells are reaches of shoreline where waves move sediment from eroding "feeder" areas (such as bluffs) to "deposition" areas (such as sand spits).

"Critical Contributing Area" (CCA) is a fourth area delineated by the report (these areas are not shown on the map). The Critical Contributing Area itself is not itself a refugia area, but directly influences downstream refugia with stream flows and/or water quality. Natural conditions such as seasonal flow or natural barriers typically prevent these areas from supporting viable salmon populations. There is typically one or more CCA associated with a Nodal Riparian Corridor. All seasonal streams draining to Nearshore and Estuarine refugia are considered Critical Contributing Areas.

Results

The map (Figure ES-4) shows the results of the study. A complete listing of refugia can be found in Table 16, pages 91-93.

Importance of non-refugia areas

Based upon the findings of this report, areas not proposed for refugia status should not be considered unimportant for regional salmon recovery efforts. Every watershed, stream, and nearshore area deserves protection and stewardship to some degree. Even the smallest watershed or nearshore area has some salmon habitat value, which may be critical to the survival of a population of fish. By the same token, degraded watersheds, streams, or nearshore areas may also still retain some measure of habitat value and therefore should be managed appropriately.

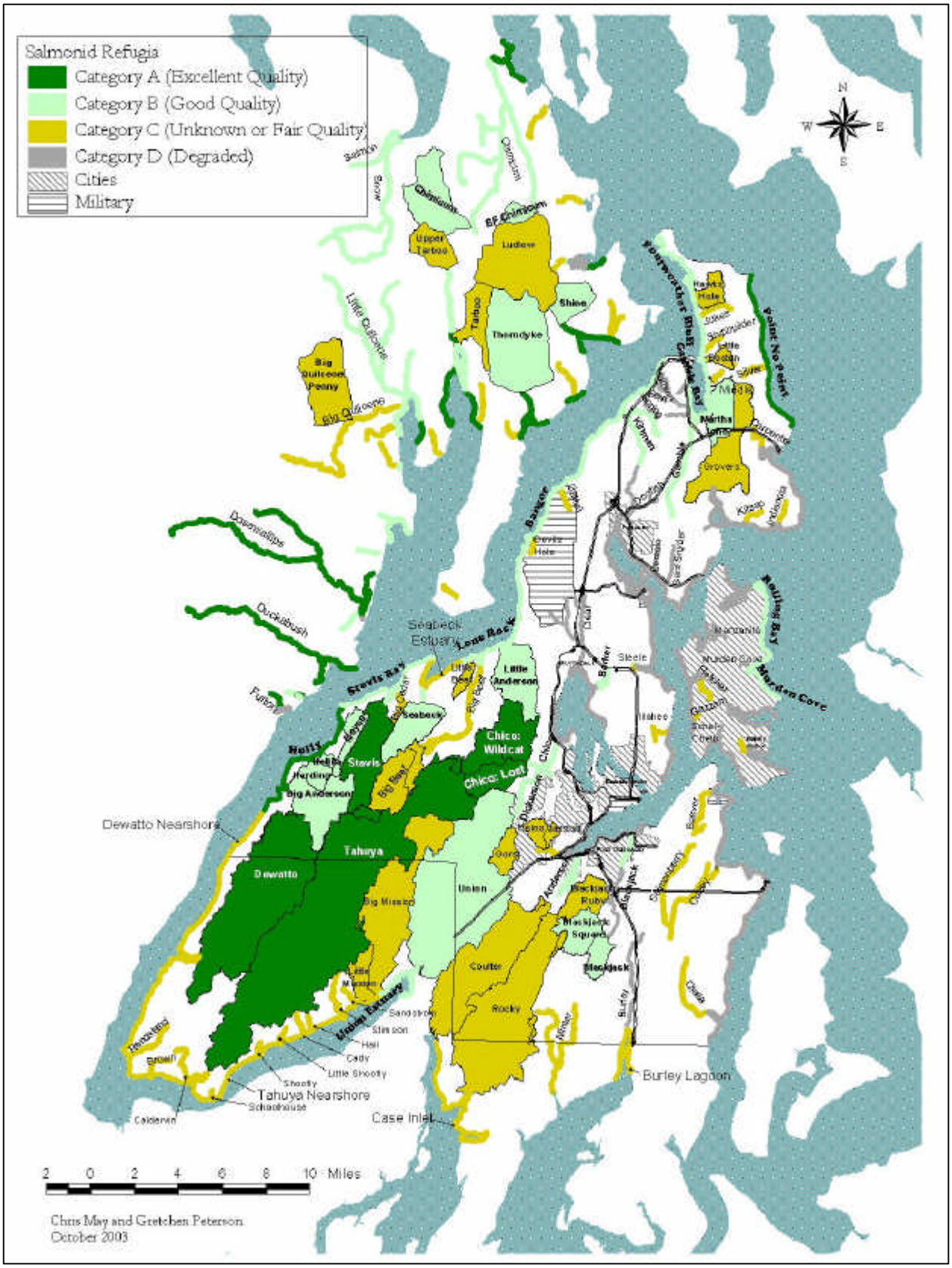

Figure ES-4: Map of Kitsap Focal Sub-Watershed, Nodal-Riparian Riparian Corridor and Nearshore-Estuarine Refugia.

Highest quality refugia and range of refugia scores

The 26 streams and nearshore areas that contain Category A & B refugia are shown in Table ES-1. There are five nearshore areas and 26 streams and in Category C. In Category D there are 18 streams and 16 nearshore areas. There were 44 streams analyzed that were deemed to be non-refugia and were not assigned to Categories A-D.

The highest freshwater refugia score was 88% for the lower reaches of the Dewatto River (the overall average for the Dewatto watershed is 82%). The lowest score was 37% for the South Fork of Dogfish Creek.

For nearshore areas the high score was 83% for the Point No Point Nearshore; the low was 19% for Sinclair Inlet.

Number of Refugia

Report classified a total of 160 individual sub-watersheds, stream reaches, and nearshore areas as refugia. The breakdown of these refugia by Category and type is shown in Table ES-2.

Interim nature of nearshore results

At the present time, our knowledge of nearshore salmonid utilization is relatively basic and is rapidly expanding. In addition, the database on nearshore salmonid habitat conditions is also relatively sparse. Therefore, this assessment of nearshore salmonid conditions should be considered as "interim" until more and better data is developed.

Highest Category for this Stream	Stream/Nearshore Name	Average Score for this Stream
A	Point-No-Point Nearshore	83%
A	Stavis Creek	83%
A	Dewatto River	82%
A	Holly Nearshore	79%
A	Tahuya River	78%
A	Chico Creek	71%
B	Murden Cove Nearshore	75%
B	Harding Creek	74%
B	Big Anderson Creek	74%
B	Nellita Creek	73%
B	Union River	72%
B	Boyce Creek	72%
B	Foulweather Bluff	69%
B	Stavis Bay Estuary	69%
B	Martha John Creek	69%
B	Seabeck Creek	67%
B	Lone Rock Nearshore	67%
B	Rolling Bay Nearshore	66%
B	Little Anderson Creek	64%
B	Port Gamble Bay	64%
B	Union Estuary	63%
B	Kinman Creek	61%
B	Gamble Creek	61%
B	Blackjack Creek	59%
B	Barker Creek	56%
B	Steele Creek	54%

Table ES-1: Category A and B refugia.

Prioritizing habitat conservation vs. habitat restoration

It is generally understood that it is more successful and much more cost-effective to prevent habitat degradation rather than restore damaged areas. Protecting the "last best places" is an essential part of the salmon recovery process. This report is designed to identify where to focus resources to efficiently and cost-effectively protect key areas.

	FWS	NRC	NSE	Total
Category A	6	0	2	*8 (5%)*
Category B	10	18	8	*36 (23%)*
Category C	14	45	5	*64 (40%)*
Category D	0	36	16	*52 (32%)*
Total	*30 (19%)*	*99 (62%)*	*31 (19%)*	**160**

Table ES-2: Frequency of Refugia by Type and Category.

Where habitat conditions have been degraded, restoring natural runs of native salmon will require that stream corridors, watersheds, and nearshore areas be brought back to a higher quality condition.

This study does not imply that protection of the designated refugia areas alone is ecologically sufficient to support salmon recovery or even to maintain current conditions within the region. Maintaining refugia is considered a necessary first step in a comprehensive, long-term ecosystem conservation program.

Conclusions

The available data indicate several common problems throughout the study region. These include (in no specific order):

- Natural stream ecological processes have been significantly altered due to the cumulative effects of watershed land-use practices and human encroachment into the stream-riparian ecosystem.

- There has been a significant shift in the natural hydrologic regime of many watersheds, especially those undergoing urbanization. This is characterized by increases in peak flow frequency, duration, and magnitude due to increased stormwater runoff from lands that have been converted from native forest and wetlands to developed landscapes dominated by impervious surfaces.

Example of a Kitsap stream with altered riparian vegetation, a lack of LWD, and an altered stream channel.

- Streambed stability and spawning gravel quality have been degraded by high stormflow scour and fine sediment deposition. Major fine sediment sources include logging roads, construction sites, and agricultural fields.

- Stream channel morphological changes have resulted from direct alterations such as agricultural channelization or floodplain diking. In addition, streambank erosion has increased in frequency and extent due to higher stormflows, loss of natural vegetation cover, and subsequent streambank armoring.

- There is a general lack of adequate large woody debris (LWD) in streams, particularly large, stable coniferous "key" pieces that are critical to forming pools, providing cover for juvenile fish, retaining organic matter, and maintaining instream habitat complexity. In addition, there is a general lack of adequate, high-quality rearing habitat (pools) for juvenile salmonids and the lack of deep "holding" pools for adult salmon migration.

- There has been a significant degradation and loss of natural floodplain processes in our rivers and larger stream systems, including the loss of functional off-channel wetland habitat. This is mainly due to dredging, bank armoring, and stream channelization. Past and current agricultural land-use has had a significant impact on floodplain and riparian processes in a number of lowland watersheds. In addition, development has also continued this process of stream channel manipulation.

- Almost all local streams have experienced a loss of natural riparian function due to removal or alteration of natural riparian forest vegetation. This degrades water quality, increases streambank erosion, reduces shade needed for water temperature regulation, and impacts instream habitat conditions through the decline in LWD recruitment.

- Stream-riparian corridor fragmentation is a major problem in many watersheds. This fragmentation has impacted the structure and function of our stream-riparian ecosystems. In addition, there are a significant number of culverts, diversion dams, and other fish passage barriers throughout these same watersheds.

- Estuarine and nearshore processes have been significantly impacted by physical alteration of nearshore ecological structure and function. These impacts include extensive shoreline bulkhead construction, loss of shoreline forest and large woody debris recruitment, loss of shoreline riparian cover and shade, and degraded water quality. In addition, natural sediment transport and beach nourishment processes have been disrupted as nearshore drift-cells have been altered by shoreline armoring, dock construction, and other human activities. All of these modifications have impacted salmonid habitat in the nearshore environment to some extent.

- Other impacts (e.g. hatcheries and harvest) have also significantly affected salmonid populations, however those issues are beyond the scope of this report.

Recommendations

Throughout the report, the author makes several general recommendations, including:

- Protection and restoration activities should be prioritized to focus on critical watersheds, streams, or reaches that have the potential to protect and reestablish core populations at strategic locations within mainstem river systems, estuaries, and tributaries.

- Preserve native vegetation as much as possible in critical nearshore areas, estuaries, and sensitive (steep banks and landslide-prone) shorelines.

- Reduce to negligible levels the impacts of shoreline development in all Nearshore and Estuarine refugia areas.

- Investigate Category C refugia where insufficient quantitative data existed to justify a Category A or B rating.

- Integrate monitoring and feedback with management so that conservation efforts may be continually refined ("*adaptive management*").

- Develop integrated watershed plans to manage current and future human activities in a way that minimizes our impacts on the natural environment. This is necessary to sustain our natural resources and protect our own quality of life.

The report concludes with the following recommendations:

- Continue to evaluate freshwater habitat conditions throughout watershed and correct identified salmonid habitat limiting factors.

- Develop salmonid habitat conservation programs that include protective purchases, conservation easements, and voluntary stewardship elements.

- Because salmonids are adapted to spatially and temporally varied local habitat conditions, it does not make sense to manage for the same conditions at all locations, or to expect

conditions to remain constant at any one location. A "one-size-fits-all' solution is rarely appropriate in the case of salmonid habitat conservation and restoration.

- Evaluate all known and potential adult and juvenile salmonid migration barriers in the watershed. Prioritize and correct all migration barriers as necessary.

- Protect stable natural hydrology within the watershed. Conserve native forest cover throughout the watershed and minimize impervious surfaces in all developed areas.

- Restore floodplain function, natural channel configuration, and stream channel migration zone. This should include consideration of dike and levee removal, road and residential relocation, and restoration of off-channel and historic slough habitat.

- Develop and implement a forest road management plan to reduce erosion and other impacts from logging roads. Ensure timber harvest operations are conducting with long-term sustainability as a goal. The principles of ecosystem management should guide all logging activities.

- Protect and enhance natural estuarine structure and function. Maintain connectivity with the adjacent nearshore.

- Restore natural riparian integrity throughout the watershed; encourage conifer regeneration in deciduous stands that historically had a conifer component, particularly in disturbed areas. This effort should include planting conifers (cedar, hemlock, and spruce), reducing riparian corridor fragmentation, and the establishment of ecologically appropriate riparian buffer zones.

- Reconnect and restore historic riparian wetlands and other off-channel habitat, where possible.

- Develop and implement a short-term large woody debris strategy until full riparian function is restored.

- Reduce impacts of roads and road crossings, including increased stormwater runoff to surface waters, non-point source water quality impacts from stormwater runoff, and increased fine sediment delivery from road surfaces and associated ditch maintenance. Correct all fish passage barriers as soon as practicable.

- Reduce habitat impacts from hobby farms and agricultural lands, including development and implementation of farm plans that restore stream functions; identify and correct areas in the watershed that have unrestricted livestock access.

- Implement a long-term biological monitoring program for the creek using the macroinvertebrate-based benthic index of biotic integrity (B-IBI). Biological monitoring is an excellent tool for diagnosing and qualifying watershed health and is a good way to involve citizens in the assessment process.

- Implement an exotic vegetation management program in the watershed.

- Identify and correct sources of known water quality problems. Continue to monitor for water quality problems.