AN EVALUATION OF THE SKAGIT BASIN COHO SSHIAP/LFA DATABASE

AND AN

ASSESSMENT OF THE DNR LAST FISH WATER TYPE MAP

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INTRODUCTION

Recent changes to Forest Practices Regulations (Forests and Fish Report 1997) spawned out of concerns of inadequate protections to fish resources and pending Endangered Species Act (ESA) listings of local salmon stocks have led to the development of a potential predictive fish habitat model for the purpose of identifying and classifying all fish-bearing and end of fish habitat waters in western Washington. The "model", a GIS-based logistic regression model, was to be developed using existing data (10m digital elevation network, precipitation, gradient, and basin size) coupled with survey-verified end of fish distribution points scattered throughout the western portion of the State. The model was given a performance target for accuracy of 95% with± 5% likelihood –"*that the line demarcating fish and non-fish habitat waters will be drawn so as to be equally likely to be over and under inclusive…"*. In preparation for an evaluation of the new fish habitat model, the Skagit River System Cooperative (SRSC) Forest and Fish program set out to determine the accuracy of the existing coho salmon upper extent distribution portion of the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) database for the Skagit basin and compare those results with the preliminary fish habitat model output maps.

The SSHIAP database is a spatial data system that characterizes salmonid habitat conditions and distribution of the salmonid stocks in Washington. SSHIAP is a co-management-based dataset operated jointly by the Washington Department of Fish and Wildlife (WDFW) and the Northwest Indian Fisheries Commission (NWIFC) that covers WRIAs (Water Resource Inventory Areas) 1-62. In WRIAs 3 and 4, the salmonid distribution portion of the SSHIAP database was primarily established through the efforts of a technical advisory group (TAG) that convened to provide input to the habitat limiting factors analysis (LFA) that affect the natural production of salmonids. Salmonid distribution is arguably one of the most important outcomes of the LFA.

The goal of our study was to verify and determine the accuracy (ground truth) of the LFA coho distribution database and to further use the verified data as a base to expand and evaluate the preliminary fish habitat model maps. Our first concern with the proposed fish habitat model was to make certain that the output maps would be inclusive of known fish distribution and designate it as such (i.e., type F), in addition to designating potential or likely "fish habitat" that may or may not have fish present during our "snap-shot" sampling period. Protection of fish and fish habitat is a key goal of the Forests and Fish Report.

Coho salmon LFA distribution points were used in this investigation for several reasons. It is a large data set in the Skagit basin with 519 points (562 points if you include the Baker River system; not included in our study). Coho typically utilize the furthest upstream reaches compared to the other salmon species; therefore, coho protection should be inclusive for all salmon species and provide a "conservative" standard for what should be called fish habitat waters. We also have a better understanding of coho distribution than we do for resident fish species (e.g., cutthroat and rainbow trout, native char, dace, lamprey, and sculpin). In addition, Tribes in the Skagit drainage depend on salmon for

both income and their cultural significance; therefore, they place a high priority on their protection and restoration.

METHODS

We generated a random sample of 10% of the 519 LFA coho points in WRIAs 3 (Lower Skagit/Samish) and 4 (Upper Skagit), and the Colony Creek system in WRIA 1 (Nooksack; included 6 points of the 519) for field verification. Sites were located across a mixed range of ownership groups ranging from very small landowners up through industrial forest landowners and public lands, including both State and Federal ownerships. We attempted to contact all landowners on all the selected sites to acquire access permission.

We used an electroshocker to sample 100 meters up- and downstream of each randomly selected coho distribution point to assess the presence/absence of coho. Global positioning system (GPS), compass, orthophotos, USGS maps, in-house GIS-produced maps, photos, and a metric hip chain were used to aid us in determining our location in the field. For the purposes of this study, accuracy was considered adequate if the mapped LFA coho distribution point(s) were located within 100m of a physical feature that would be considered a migration barrier (includes gradient breaks, falls, other natural barriers, and some anthropogenic barriers). Due to the methodology by which the LFA data were collected over the years (a habitat limiting factors analysis through contributions of a technical advisory group, published sources, survey notes, and biologist observations), we assumed that 100m would be appropriate to cover some unknown level of mapping error.

Electrofishing was conducted with a Smith-Root LR-24 backpack electroshocker equipped with a rat-tail style cathode and standard ring anode pole. We used the "quick setup" function to establish a starting point for the output voltage in each stream and incrementally (50-100V) increased voltage, if necessary, depending on the behavior of the fish observed in the electric field. Sampling was conducted within the "accepted" survey timing window of March 1st through July 15th when water (and fish) were most likely to be present in the stream channel (Forest Practices Board Manual Section 13, 2002). Due to the time of the year (as it relates to emergence and the relative size of fish being targeted), we often times increased the voltage 100V from the quick setup and began our sampling from that reference point. Shocked fish were handled with care. All fish were identified to *Genus species* and recorded according to their capture location relative to the mapped LFA point (i.e., upstream or downstream). We focused our sampling around each coho distribution point as though it were centered in a 200m sampling treatment. We conducted our presence absence surveys starting at the downstream end of the sampling treatment and working upstream and electrofished the 200 meter segment. If there was a potential barrier (natural or man-made) encountered within the segment and coho were detected downstream, we sampled upstream to assess coho presence. In cases where a coho was not detected within the segment and time permitted, we sampled to significant habitat breaks (falls, cascades, debris jams). If coho were not found in or throughout the reach, we visually assessed the area based on best

professional judgment and probability for access during alternate times of the year (i.e., overwinter habitat usage).

We collected additional stream-specific data in the 200m sampling area. Physical data, including bank full width (bfw), bank full depth (bfd), wetted depth, and gradient (%) at water surface elevation were measured at intervals of approximately 25m below and above the mapped LFA coho point (8 transects per mapped site). Residual pool depth was measured if a significant pool (pool that appeared capable of over-summering fish during low or no flow conditions) was encountered in our sampling reach. Subjective measures of whole-reach substrate type(s) were visually estimated and recorded. All barriers, specifically those pertaining to coho at various life stages, were also noted as to size, type, and location relative to the LFA point. For the purpose of this report, no further analysis of these data will be provided.

For the second portion of our study we used our ground-truthed LFA coho distribution data set and analyzed it against the GIS-based fish habitat model output data obtained through the Washington Department of Natural Resources website (DNR) http://www.dnr.wa.gov/ to evaluate the potential habitat protection provided by the proposed model on known fish distribution. Finally, we used the existing DNR hydro maps and the 519 coho points to evaluate current mapped levels of protection to fish and compare them with the proposed model protection.

RESULTS

Of the 51 sites randomly selected and distributed across the Skagit basin, we were granted permission to sample 40 sites from 13 April through 16 June 2004; of the remaining 11 sites, 3 were not accessible due to damage from the October 2003 flood that blocked numerous access routes across the basin. Eight were not sampled due to failure to acquire access permission. Permission for access was granted by all landowner groups, but small private landowners (i.e., single family residence owners) were the most difficult to contact and secure permission for access.

In all, 26 of 40 (65%) SSHIAP coho points were determined to be accurate representations of where coho distribution truly ended (+/- 100 meters of end of distribution). Twelve points (30%) were determined to be inaccurate according to our definition; either coho could not get there (1), or we physically observed (2) or believe (9) coho distribution extends further than 100m above the map point due to channel gradient uniformity or lack of a discrete physical barrier. Two points (5%) were not resolved and determined to be of unknown accuracy. One site was dry and of questionable physical characteristics and the other was on the south fork of the Cascade River and could not be resolved due to questions of adult access. It was, however, acknowledged that coho more than likely could make it to at least the mapped distribution point(s) at some time of the year. Of all 40 sampled sites, only one site was found to be a gross over representation (approximately 900’ upstream) of coho distribution. At that site, there was no possibility of access due to downstream channel characteristics (26% gradient) and a road grade prism had been placed over the stream

channel with no visible culvert to route surface waters. Therefore, 39 (97.5%) out of 40 points were assessed to have coho associated with them at some time of the year.

Fifty percent (20) of our sampled coho distribution points occurred within 100m of a measurable physical barrier (includes natural and man-made). A variety of coho-migration barriers were found ranging from tidegates, dams, and road prisms to terrace walls and temporary debris jams. The most commonly encountered barriers were problem culverts (5) followed by falls (3), debris jams (3), and cascades (2). Several coho points were located at the head end of sloughs and were not necessarily defined as a barrier since water doesn't continue beyond the LFA point. Nonetheless, these points did not show up on the model maps and are of those that are not protected.

Coho Distribution vs. Fish Habitat Water Type Model

When our sub-sampled LFA coho points were overlaid on the proposed fish habitat water type (FHWT) maps, 35.9% (14) of our sample sites were not identified (i.e., not protected) as fish-bearing waters (e.g., considered type N streams); 64.1% (25) of sites were correctly identified as type F waterbodies but may not have extended to the true end of fish distribution or more importantly fish habitat (Table 1). Three of the 14 coho points did not have a mapped or modeled waterbody associated with them. These points were in the low-elevation, low-gradient floodplain areas of the Skagit River. Of the remaining 11 points, the average distance from the modeled end of fish point to the mapped coho distribution point was 890' (standard deviation ±386.8) with a maximum distance of 1560' and a total of 9796' for all 11 sites.

Similarly, when our sub-sampled coho distribution points were examined against the current DNR hydro layer 23% (9) were not protected by the map (typed as 4, 5, or unmapped) and 64.1% (25) are considered fish-bearing (typed as 1, 2, or 3) and 12.8% (5) are on untyped streams (Table 1), though it is important to note that the current water type rule in effect does protect all our sites with default physical criteria established in the Interim Water Type Rule (WAC 222-16-031). The one site that was field verified to be overly inclusive of coho distribution was excluded from this analysis because the error lies in the original LFA map. Of the unprotected LFA coho data points, unmapped streams accounted for 7.7% (3) and 5.1% (2) for modeled fish habitat map vs. current DNR hydro layer, respectively (Table 1).

Basin-wide Coho Distribution vs. Fish Habitat Water Type Model

Because we found only one LFA coho point to be an overrepresentation of coho distribution (i.e., small margin or error), our analysis was expanded to all SSHIAP coho points in the Skagit basin (WRIAs 3 and 4 excluding the Baker system and the Colony Creek system in WRIA 1). We found that 81 of the points (15.8%) were located on Type N streams and 81 (15.8%) were located more than 300' from any modeled water. Collectively, 162 out of 513 points (31.6 %) are located greater than 300' from a modeled Type F waterbody (Table 1).

We also used the whole-basin coho distribution approach and compared points against the existing water type map; our results are summarized in Table 1. We found that

collectively 223 of 513 points (43.5%) were more than 300' from Type 1, 2 or 3 waterbody Of these 223 points, 65 (29.1%) are not within 300' of any mapped water and 158 (70.9%) are within 300' of mapped waters that are not classified as Type 1, 2 or 3. Further analysis showed that 76 of the 158 points were located within 300' of "Type 9" waters; streams that DNR has mapped but has not assigned a "water type" Many of the "untyped" streams are in federal ownerships such as USFS and the North Cascade Park complex although they are scattered throughout both WRIAs. Eliminating these 76 points from the analysis results in 147 of 437 (33.6%) coho points designated as "unprotected" in the existing water type maps. Eighty-two of the 147 points (55.8%) were within 300' of type 4 or 5 waters and 65 of the 147 (44.2%) were not located within 300' of any waters.

Table1. Breakout of coho distribution points using the Limiting Factors Analysis data by type for the proposed Fish Habitat Water Type maps (FHWT) vs. the existing DNR hydro layer.

	Field Verified LFA Coho Points				Basin-wide LFA Coho Points			
	FHWT	%	DNR	%	FHWT	%	DNR	%
Type "F" or "1,2,3"	25	64.1%	25	64.1%	351	68.4%	290	56.5%
Type "N" or "4, 5"	11	28.2%	7	17.9%	81	15.8%	82	16.0%
Type "9"			5	12.8%			76	14.8%
No Water	3	7.7%	2	5.1%	81	15.8%	65	12.7%
Total	39		39		513		513	

CONCLUSIONS

The SRSC LFA fish distribution survey prior to the release of the Fish Habitat Model results establishes a high degree of accuracy for the Skagit River Basin data (39 out of 40, or 97.5%of the LFA coho points were field verified to have coho present or to be coho habitat). The accuracy shown by the LFA distribution data with respect to the presence of coho and/or coho habitat provides a sound baseline for evaluating related mapped or modeled fish protection programs. Both the current water-type system and the proposed habitat model identified the same number of points (25) to be in "fish" waters. Of the remaining 15 points, one was not a coho-bearing water and the remaining 14 were incorrectly identified due to typing errors or the failure to have mapped the water in the first place. This 65% (26 of 40 points) accuracy of identifying fish distribution by both the FHWT and the existing water type system in the sample is similar to 68% "fish water" identification by the FHWT for 514 coho points in the basin and somewhat better than the 57% identified as "fish water" by the existing water type maps. However, the existing water type maps are quite similar (66%) to FHWT results in their identification if the points on the "untyped" streams are removed from the analysis.

Recommendations

Our short term (10 years) recommendations are to retain the Interim Water Typing rule (WAC 222-16-031) and require DNR to develop and implement a tracking and map updating system that will add both accurate water and fish information to the existing water type map as they are submitted. Long range (> 10 years) recommendations include the development of an **accurate** hydrography for the State of Washington. The Hydro Framework project had this as one of its goals but the process seems stalled, at least for the past couple of years. Once the accurate location of the stream network has been established, then modeling efforts for some fish species may prove to be a worth while effort, especially if a good job is done with the updating process over time.