SOUTHWEST REGIONAL RISK ASSESSMENT FOR WHIRLING DISEASE IN NATIVE SALMONIDS: DATA ASSEMBLY AND CONCEPTUAL MODEL DEVELOPMENT

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Introduction - Recent decades have witnessed the decline of native fishes throughout the southwest that have resulted from widespread anthropogenic landscape alterations, a general decrease in surface waters and introduction of non-native species. Many of the native salmonids are represented by fragmented populations sparsely scattered throughout remaining habitat restricted to high elevation streams. Of particular interest is the relatively recent introduction and spread of *IVIyxobolus cerebralis* and its effects on imperiled native salmonids. *itlyxobolus cerebralis* has been identified throughout the southwest region of the U.S. exhibiting epizootic levels in both native and non-native salmonid populations. Thus, the most devastating potential of infection by the parasite is the threat it poses to native salmonid populations that rely on natural reproduction. State fishery managers have requested a tool to aid in formulating strategies to prevent the spread of the parasite and assist in mitigation efforts.

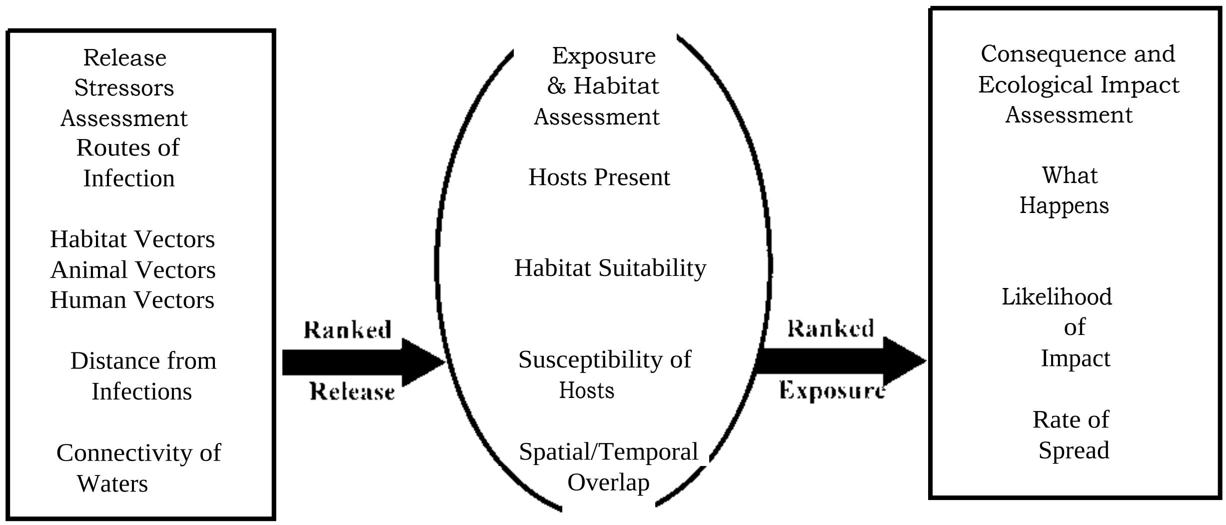
This research project is designed to examine landscape patterns in the transmission and prevalence of the parasite throughout the southwest region. Thus, our goal is to develop a spatially explicit risk assessment model that will allow managers to assess the risk of whirling disease exposure and establishment within watersheds of interest. By integrating spatial data, we can develop a series of risk assessment models specific to unique watershed types so that effective management strategies may be formulated. The relevance of this research pertains to identifying key factors that affect incidence and infection levels and thus potential of Al *cerebralis* occurrence not only within arid/semi-arid regions but other more mesic regions.

Our project objectives are to (I) identify management goals for each state cooperator; (2) gather and integrate relevant and spatially explicit data sets from state cooperators; (3) develop a conceptual model and identify sub-regions; (4) develop a spatially explicit regional map depicting disease sources. supporting habitat, and native species distribution within each sub-region; (5) develop a ranking scheme for exposure, establishment, and consequences for all model parameters within the sub-region; (6) calculate risk for each scenario for the sub-regions; (7) evaluate the uncertainty and sensitivity of the models; (8) generate testable hypotheses and validate model outcomes; and (9) communicate risk assessment results for disease exposure, establishment, and consequences of native salmonid populations to stakeholders.

The regional scale risk assessment proposed in this project is adapted from the relative risk model described by Landis and Wiegers (2000). We adapted and modified the ranking schema described in regional risk assessments for our conceptual model within the framework of aquatic animal health risk assessments (Figure 1). Spatially explicit risk models for contaminant severity, potential biological invasions, and the effect of specific land use practices have been evaluated at regional scales (see Landis 2005). Thus, the tools we have implemented for this task (geo-database and network analysis) are applicable in characterizing probable paths and risks for dispersion of Al *cerebralis* at a regional scale. The risk analysis identifies infection locations and assigns a surface value to attributes of each segment of the geometric network. The analysis then calculates the risk potential, pathway of spread, and overall risk. The dynamic nature of geometric network analysis allows the user to immediately evaluate the effect of a new infection location on the surrounding stream network. Specific pathways can be theoretically blocked (for example, by a proposed barrier) and the associated total risk of infection throughout the system is immediately updated. Using these techniques numerous risk scenarios can be evaluated simultaneously.

Progress - To date, we have made substantial progress in developing management goals, data acquisition, and have continued to develop conceptual models for analysis since the start of the project, August 2006. We have

Figure 1. Conceptual Model of the Regional Whirling Disease Risk Assessment



received data in a variety of database formats including Access databases, paper data sheets, and summary reports. All data collected has been formatted and entered into an Access database. This database platform was chosen as it is compatible with the ArcGIS spatial programs and may also be queried and used with many PC-based programs.

We have received some M. *cerebralis* testing data from the entire region. We anticipate that this data set will be complete when additional datasets from Colorado and Wyoming are received. We have received occurrence and population data on Colorado River cutthroat, Rio Grande cutthroat, Apache trout, and Gila trout. Data on greenback cutthroat trout is expected to be finalized and received after the conservation team meeting for the species in mid-January 2007. We have received data on the genetic status of native trout populations. migration barrier status and location and co-occurrence of non-native trout species. We still lack data in many areas on non-native occurrence, stocking programs and specific watershed data on landscape features and water quality. We have been and will continue to work with state partners to facilitate acquisition of needed data.

We have also gathered detailed spatial data from various sources for the region. Data sets include: National Elevation Dataset (NED), slope and aspect (Derived from NED), National Hydrology Dataset (NI-1D 2003 snapshot). National Hydrology Dataset (NHD December 2006 snapshot), PRISM (AVG high temperature, low temperature, precipitation, dewpoint, and accumulated precipitation by month 1971-2000), Statsgo (general soils), ETM+ mosaic (RGB satellite image), NHDPIus (value added product of EPA), Stewardship (land ownership and management categorization), National Transportation Atlas (detailed road network), and Water-Quality Data (multiple sources and types). Data derived from these datasets provide stream and watershed level data for inclusion in the model (e.g., water type, stream order, gradient, elevation range, connectivity to other waters, land cover type, geology, soil type, land ownership or management, watershed area, flow, physical and water chemistry parameters).

References

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