

LIFE-CYCLE MODEL DEVELOPMENT AND APPLICATION, AND ANALYSIS OF FISH-HABITAT RELATIONSHIPS

9203200

SHORT DESCRIPTION:

Improve decision-support tools for (1) assessing overall program effectiveness, and more specifically (2) assessing the impacts of land-use activities on resident and anadromous salmonids.

SPONSOR/CONTRACTOR: USFS-INT

USDA Forest Service, Intermountain Research Station

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SUB-CONTRACTORS:

NA

GOALS

NPPC PROGRAM MEASURE:

BPA SUPP

RELATION TO MEASURE:

Although this project is not aimed at a specific program measure, it is relevant to several major objectives of the 1994 program, specifically Section 3.2 (adaptive management, integration of monitoring, evaluation and research into a unified framework to assist decision makers); Section 4.2A (system-wide analysis of major uncertainties); Section 4.3 (rebuilding targets, performance standards, and monitoring); Section 5.0A (specific hypotheses); and Section 7.1E (population vulnerability analyses).

BACKGROUND

Project is an office site only

HISTORY:

This project is part of a larger effort that has been funded by the USDA Forest Service (FS), Bonneville Power Administration, and the National Marine Fisheries Service. It began as an effort to (1) improve the Stochastic Life-cycle Model and provide parameter estimates for Snake River stocks, and (2) investigate means for cataloging habitat inventory information within a Geographic Information System (GIS). The effort has since grown to a more fully integrated look at how spatially explicit habitat and landscape information can be incorporated into population viability assessments. Most recently, this effort contributed to methods used within the Interior Columbia Basin Ecosystem Management Project (ICBEMP) that was completed by the FS and Bureau of Land Management. The principal FS investigator also participates as a member of the interagency committee that is engaged in the PATH process, providing data, analyses, and technical expertise. Funding to support the principal investigator and other scientists working on this project has come primarily from the Forest Service. Supplemental funds from Bonneville and NMFS have been used to support biological technicians and contract personnel, and cover miscellaneous operating expenses.

Decision-support tools developed under this project play an important role in ongoing assessment and planning activities. The SLCM model is one of the principal models used by Bonneville and NMFS in assessing the possible impacts of proposed activities on threatened and endangered chinook stocks. Stream inventory and GIS techniques developed by Forest Service researchers are used throughout the Northwest. Recent work included development of a set of models, called the Bayesian Viability Assessment Modules (BayVAM) that can be used to assess habitat condition in terms of suitability for both resident and anadromous salmonids. These models are unique in that they allow expert knowledge to be combined with quantitative and qualitative information in a rigorous, repeatable, and defensible manner. They have been tested in watersheds throughout the Northwest, and will soon be incorporated into the Federal watershed analysis protocols. Technical transfer is an integral part of the overall effort; numerous presentation and workshops have been presented to ensure widespread distribution of research products and ensure feedback from endusers.

PROJECT REPORTS AND PAPERS:

1992 and 1993 Annual Reports

Lee, D.C., and J.B. Hyman. 1992. The Stochastic Life-cycle Model (SLCM): Simulating the population dynamics of anadromous salmonids. Res. Pap. INT-459. USDA Forest Service, Intermountain Research Station, Ogden, UT.

Lee, D.C. and W.E. Grant. 1995. A hierarchical approach to fisheries planning and modeling in the Columbia River Basin. Environmental Management 19:17-25.

Lee, D.C. in press. Assessing land-use impacts on bull trout using Bayesian belief networks. In S. Ferson, editor. Quantitative Methods in Conservation Biology. Springer, New York.

Lee, D.C. and B.E. Rieman. (in review) Population viability assessment of salmonids using Bayesian belief networks. North American Journal of Fisheries Management.

Pinney, C., I. Parnell, and D. Lee. (in revision) Trends in upstream spawning and rearing habitat. In Plan for Analyzing and testing Hypotheses (PATH): Final report on retrospective analyses for 1996.

ADAPTIVE MANAGEMENT IMPLICATIONS:

This project has been instrumental in advancing the analytical methods and tools available to land-management agencies in the Columbia River Basin. Currently, biologists in Regions 1, 4 and 6 of the Forest Service use the population models and GIS techniques developed here to help identify priority watersheds for protection or restoration, to evaluate potential impacts of proposed land-management activities, and to identify monitoring needs.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:

The objective is the development of tools that lead to a more sophisticated and informed land management that better addresses the needs of fish.

BIOLOGICAL NEED:

Land management is a critical component of protecting and restoring fish and wildlife. To date, we have not proven capable of multiple-use management that does not harm fish populations. We would like to reverse that trend.

HYPOTHESIS TO BE TESTED:

The primary hypothesis is that land management has a measurable impact on the viability of naturally reproducing anadromous and resident salmonids. Subcomponents of this hypothesis address where, how, and to what degree.

ALTERNATIVE APPROACHES:

NA

JUSTIFICATION FOR PLANNING:

NA

METHODS:

As part of the ICBEMP, we compiled a comprehensive, broad-scale database on the status and distribution of seven widely distributed salmonids within the interior Columbia Basin, and a large amount of information on landscape characteristics such as physiographic features, vegetation, roads, dams, mines, etc. We also developed an extensive database of stream inventory data. The PATH process is currently collecting similar types of information, some of it at finer resolution than that compiled for the ICBEMP. Other data collection efforts are underway by the various regions of the Forest Service. Collectively, these data present a tremendous opportunity for exploring causal linkages between land management and fish populations. In the ICBEMP, we explored several innovative statistical techniques in order to build models that would allow us to map predicted fish distributions across the landscape, and anticipate changes in these distributions resulting from alternative management futures. We looked at generalized logistic models, empirical-k-nearest-neighbor techniques, and classification trees for this purpose. Though we made substantial progress, our work along these lines was hindered by the hurried nature of the ICBEMP project. Given more time and resources, we think that significant further gains in understanding are possible. Future work will build on our earlier efforts and improve the accuracy and extent of our models, and branch into other areas such as Bayesian methods and hypothesis testing. It

also has been suggested within the PATH process that the use of Bayesian belief networks in retrospective analysis be investigated.

PLANNED ACTIVITIES

SCHEDULE:

PROJECT COMPLETION DATE:

1999

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:

We expect to gain a better understanding of fish-land relations using existing data, develop protocols for improved data collection, provide a set of tools for spatial analysis that could be adapted for a variety of applications, and improve on available methods for viability analysis.

Contribution toward long-term goal:

Understanding of relationships among population viability of resident and anadromous salmonids, habitat conditions, and land-use activities; integrated decision-support tools using decision-theoretic methods.

Indirect biological or environmental changes:

NA

Physical products:

NA

Environmental attributes affected by the project:

NA

Changes assumed or expected for affected environmental attributes:

NA

Measure of attribute changes:

NA

Assessment of effects on project outcomes of critical uncertainty:

NA

Information products:

{101L} Decision-support tools developed under this project continue to play an important role in ongoing assessment and planning activities. The improved SLCM model is one of the principal models used by Bonneville and NMFS in assessing the possible impacts of proposed activities on threatened and endangered chinook stocks. GIS techniques pioneered by FS researchers are being used by National Forests throughout the Northwest, the Interior Columbia River Basin Ecosystem Management Project (ICRBP), and the Model Watershed process. Recent work has focused on development of a set of models, called the Bayesian Viability Assessment Modules (BayVAM) that can be used to assess habitat condition in terms of suitability for both resident and anadromous salmonids. These models are unique in that they allow expert knowledge to be combined with quantitative and qualitative information in a rigorous, repeatable, and defensible manner. They currently are being tested in a subsample of watersheds from California to Montana. Following the testing phase, the BayVAM modules will be incorporated in

the Federal watershed analysis protocols. Technical transfer is an integral part of the overall effort; numerous presentations and workshops have been presented to ensure widespread distribution of all research products and allow feedback from endusers.

Coordination outcomes:

Because of the efforts of this project, the results of the Interior Columbia Basin Ecosystem Management Project are being made available to, and integrated with, other ongoing efforts within the Fish and Wildlife Program. This has provided a much more comprehensive look at resource issues with the Columbia Basin than otherwise would be possible.

MONITORING APPROACH

Provisions to monitor population status or habitat quality:

NA

Data analysis and evaluation:

NA

Information feed back to management decisions:

NA

Critical uncertainties affecting project's outcomes:

NA

EVALUATION

The performance of this project is best evaluated on the basis of the quality of the research, as judged by published manuscripts in peer-review journals, and by the utility of the tools and methods developed, as judged by their use in field and in decision making.

Incorporating new information regarding uncertainties:

NA

Increasing public awareness of F&W activities:

Numerous presentations, both before professional societies and in more public meetings, have been and will continue to be made as part of this effort.

RELATIONSHIPS

RELATED BPA PROJECT

9600600 PATH - Facilitation, Tech Assistance & Peer review

9202603 Idaho Model Watershed: Modeling for Planning and Implementation

RELATIONSHIP

9203200 funds participation by Danny Lee in PATH

Complementary efforts; information shared between projects

RELATED NON-BPA PROJECT

USFS/BLM - Interior Columbia Basin Ecosystem Management Project (ICBEMP)

RELATIONSHIP

Information gathered under ICBEMP is used by this project in analysis of land-use effects

OPPORTUNITIES FOR COOPERATION:

Information bases and analytical tools developed under this project could be shared with a larger audience via coordination with the StreamNet project (8810804).

COSTS AND FTE

1997 Planned: \$65,000

FUTURE FUNDING NEEDS:

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$68,000		100%	
1999	\$30,000		100%	
2000	\$0		100%	
2001	\$0		100%	
2002	\$0		100%	

PAST OBLIGATIONS (incl. 1997 if done):

<u>FY</u>	<u>OBLIGATED</u>
1992	\$51,160
1993	\$40,646
1994	\$40,917
1995	\$15,280
1996	\$50,000

TOTAL: \$198,003

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

FY OTHER FUNDING SOURCE

1998	USDA Forest Service
1999	USDA Forest Service

AMOUNT IN-KIND VALUE

\$30,000	\$80,000
\$20,000	\$80,000

OTHER NON-FINANCIAL SUPPORTERS:

National Marine Fisheries Service, Environmental Protection Agency (some funds from EPA may be forthcoming).

1997 OVERHEAD PERCENT: 17%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:

total

CONTRACTOR FTE: 3

SUBCONTRACTOR FTE: 0