Draft Review of the Washington State Salmon Recovery Funding Board’s Comparative Cost Effectiveness Analysis

Independent Economic Analysis Board

Task Number 125

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In accordance with the Statement of Work for this review task, the IEAB reviewed Chapter 6 Cost Effectiveness Analysis of a draft report from Tetra-Tech EC, Inc. entitled “Reach-Scale Effectiveness Monitoring Program: 2006 Annual Progress Report”. Our comments suggestions on the appropriateness and feasibility of the proposed approach to measuring cost effectiveness of alternative watershed restoration treatments are included below.

SUMMARY OF REPORT ACCOMPLISHMENTS

The report describes methods to assess and monitor the effects of numerous salmon restoration projects. These are quantified with a series of indicators. Some indicators are direct measures of salmon abundance (spawners and reds per kilometer of stream, and numbers of juveniles per square meter). Ideally, these measures are monitored in both control sites and project sites, before and after the implementation of restoration projects. Called a BACI design (Before After Control Impact), this procedure generates indicators needed to monitor the effects of restoration efforts. For some categories of projects (instream structures, riparian planting, and livestock exclusion project) indicators include physical features of the restored habitats (e.g. pool depths, stream flows, riparian canopy density, and proportion of eroding banks). These latter measures provide indicators of project success at creating some habitat characteristics deemed important to salmon restoration. Where direct measures of increased salmon usage of the restored habitat are not practical, these indicators of altered habitat provide a less direct measure of project success.

The report converts the indicators of project impact described above to a “percent mean difference”, where the mean difference for any indicator compares restoration project sites and control sites. For any given project category, both control sites and project sites are monitored before the project is implemented (called “year 0” in the report), and again in a later year (called “year 1” in the report). To obtain the “percent mean difference” indicator, the change in mean difference from year 0 to year 1 is divided by the mean difference in year 0. This indicator can be calculated for any site, or set of sites, and for any indicator monitored at the sites. Averaged over a number of sites, the change in the mean difference indicates whether a set of restoration projects caused an improvement in habitat condition or salmon abundance (juveniles, reds, or adult spawners).

To implement a cost-effectiveness analysis, the report also provides a measure of project costs. To assign a comparable cost estimate to each project, the report divides each total project cost by the estimated life span of the project. This yields a simple estimate of annual costs which can then be compared to the percentage mean difference between the restored and control sites. In the cost-effectiveness investigation in Chapter 6, the indicators of effectiveness and cost per year are computed and displayed for 24 projects.

Finally, the report correctly notes that cost-effectiveness can be a useful element in project selection when, with a limited budget, a set of projects must be chosen to maximize the restoration effect; or, with a specific restoration goal (e.g. a target fish population size) a set of projects is chosen to meet the goal at minimum cost. The report then summarizes the cost-effectiveness measures for 24 projects. To illustrate what might be learned from the indicators
and associated annual costs the report provides eight graphs plotting the mean difference indicators versus the project costs. Eight indicators of mean difference are displayed – differences in (1) juvenile coho density, (2) steelhead parr density, (3) chinook juvenile density, (4) mean thalweg vertical pool profile area, (5) mean residual pool depth, (6) riparian vegetation structure, (7) riparian shading, and (8) bank erosion. Not all projects have all eight indicators. For each of the indicators, there are between 6 and 11 projects.

**REVIEW COMMENTS AND SUGGESTIONS**

**General Comments**

We strongly support the development of the carefully designed field work described in the TetraTech report. Without such detailed monitoring, it would not be possible to evaluate the effectiveness, let alone cost-effectiveness, of the diverse and widespread recovery efforts funded at SRFB. The fact that they were able to quantify the effectiveness of the recovery projects using criteria related to changes in salmon abundance is very encouraging.

Ideally, we would like to see an overall measure of salmon recovery effectiveness monitored for every type of recovery site. This would permit an assessment of the cost-effectiveness of all types of recovery efforts for all species. For example, if the numbers of juvenile fish were aggregated over all seven species (coho, chinook, steelhead, pink, chum, sockeye, and bull trout) the increase in “mean difference” would be a general indicator of anadromous (and resident trout) recovery effectiveness. Further, the analysts could summarize the cost-effectiveness of recovery projects in various sub-basins, as well as within project categories. This would contribute to decisions which allocate recovery funds across geographic areas. However, regional ecologists or decision-makers may desire a species-oriented effectiveness measure, especially for addressing ESA-listed species.

Where it is impossible or inappropriate to relate changes in fish abundance to recovery project impacts (e.g. for instream structures, riparian planting, and livestock exclusion projects) the indirect indicators (e.g. pool depth, riparian vegetation cover, bank erosion rates) may be useful for tracking project effectiveness at modifying habitats. But these are quantitatively incomparable to the fish abundance-based indicators.

Unfortunately, a cost-effectiveness analysis (CEA) is ill-suited to evaluate projects with multiple objectives. The analysis may identify projects which provide less enhancement to all species per unit cost, and these inferior projects could be ranked below the others. But, if one group of projects provides, for example, more coho salmon enhancement but little chinook enhancement, while another group of projects produces more chinook and fewer coho, the CEA cannot rank the projects. The analysis can reveal trade-offs among the groups of projects, but it cannot be said to rank the projects based upon multiple indicators related to multiple objectives. To go beyond a description of trade-offs among objectives to develop a ranking of projects (by type or location), the economic analysis would have assign relative values to the objectives.

To assist multi-objective decision making through quantitative rankings of alternatives the various objectives must be assigned comparable values. The economic values would represent values to fishing groups (recreational and commercial) and to the general public. This is the intent, for example, of economic benefits assessment. An economics study could attempt to establish a value for each of the species in each sub-basin. Then the sum of the values enhanced could stand as an indicator of recovery effectiveness for individual projects or groups of projects. The usual problems with this approach are (i) that the values are difficult to establish, and (ii), once established, the values can be legitimately challenged as not reflecting social commitments,
such as recovery of endangered species. Hence, we do not expect a more thorough economic assessment of salmon recovery accomplishments to solve the project selection decisions faced by SRFB and others. But we do think that the cost-effectiveness methodology, applied carefully and interpreted sensibly, could help in identifying projects, project types, and project locations which most clearly assist in recovery the species of interest.

Detailed Comments and Suggestions

1. It is not clear why the report chooses to adopt “decision criteria” associated with the percentage change in mean difference between project and control sites. Converting all the measures of change into percentages makes them all comparable in one sense. On the other hand, it obscures the differences between large and small projects. A very large project (with high annual costs) would be expected to achieve a larger increase than a small project in the indicators of recovery. Expressing the recovery indicators in percentage terms, and then displaying the percentage changes versus annual cost (as done in figures 6-1 through 6-8), does not clearly show the reader how recovery levels vary with size of project. It would make sense to display the mean difference changes in natural units (e.g. salmon spawners per km) instead of percentages. If those are displayed versus annual costs, one would observe clearly whether the larger projects (with higher costs) yield proportionately higher recovery levels.

2. Another problem with the “percent mean difference” indicator of effectiveness is that when there is no initial difference between the control site and the project site, the denominator of the “mean percentage difference” equation is zero, resulting in an infinite value. The response to this in the report is to substitute the arbitrary value 100%. This approach could bias the results of the cost-effectiveness assessment in an unknown manner. Unknown, because we don’t have information on how often, or in what types of project, this substitution is made.

3. The report displays results of the recovery indicators for categories of projects in Chapter 5. This permits a comparison of effectiveness (or cost-effectiveness) across categories. This is clearly a useful piece of information. We suggest that another means of aggregating recovery effectiveness across projects, would be to group projects geographically by sub-basin. With this grouping, we might find that some basins provide much greater contributions to salmon recovery, per dollar spent, than others. This could help to guide the allocation of recovery funds to those basins which have the most immediate effect on overall recovery of specific evolutionarily significant units (ESUs) listed under the ESA. We understand that there are other criteria and considerations that enter into the geographical allocation of recovery funds. But we also think that the SRFB would benefit from some indicators of sub-basin contribution to salmon recovery. Such quantitative estimates may assist in spatial allocation decisions.

4. We recognize that the report being reviewed is a preliminary report that reflects partial, early results from a large and long-term monitoring and assessment effort. We think that it is essential that such efforts continue and that the funding for monitoring and evaluation of recovery projects be continued, and preferably increased. Unless we develop reliable and policy-relevant information about the effectiveness and costs of projects intended to recovery depleted species, we will have difficulty determining whether, or to what extent, the large public expenditures involved have been spent wisely and effectively. And we will have inadequate information to allocate continuing funds to the most effective restoration projects.