

Individual Review Form

Proposal number: 2001-K206-2

Short Proposal Title: San Joaquin Salmon Age Determination

1a) Are the objectives and hypotheses clearly stated? The objectives and hypotheses are clearly stated. The primary hypothesis is that scale analysis and not just length-frequency distributions are needed to correctly determine the age of returning adult salmon. The proponent also alludes to many other hypotheses that could be tested as a result of this work. For example, cohort analysis was an important first step for several previous analyses showing strong correlations between the abundance of returning adult salmon to the Stanislaus and Tuolumne rivers and the magnitude of streamflow and Delta exports when the fish were migrating through the Delta as juveniles (Department of Fish and Game 1972, 1992; Mesick 2000). These correlations also suggest that the chinook salmon populations declined substantially after 1960 (Mesick 2000) and again after 1990. The proponent discusses the utility of the proposed study in regard to testing the validity of these correlations, identification of other limiting factors, and to provide a long-term baseline of population trends that can be used to help judge restoration projects.

DFG. 1972. Report to the California State Water Resources Control Board on effects of the New Melones Project on fish and wildlife resources of the Stanislaus River and Sacramento-San Joaquin Delta.

DFG. 1992. Interim actions to reasonably project San Joaquin fall-run chinook salmon (WRINT-DFG Exhibit 25.) Prepared for the Water Resources Control Board Bay-Delta Hearing Proceedings. Sacramento, CA. June.

Mesick, C.F. 2000. Factors that limit fall-run chinook salmon in the San Joaquin River tributaries. Fish Bulletin 179 (In press).

1b1) Does the conceptual model clearly explain the underlying basis for the proposed work?

The underlying basis for the proposed work is satisfactorily explained within the Statement of Problem and the Conceptual Model. The California Department of Fish and Game (DFG) uses length-frequency analysis to distinguish between two-year-olds and older fish and previously they assumed that few four-year-old and older fish returned to spawn. The preliminary results of their scale analyses indicate that in some years, four-year-old and five-year-old salmon are returning to spawn and that their lengths can be similar to those of the three-year-old fish. The proposed study should be able to determine whether the previous age determinations are adequate.

1b2) Is the approach well designed and appropriate for meeting the objectives of the project?

The approach should be adequate for meeting the objectives of the project as it contains a five-step QA/QC program. The most important aspects of the QA/QC program is that scales from coded-wire tagged (CWT) fish with known ages and an external lab familiar with Central Valley salmon will be used to validate the techniques. However, their approach could be improved by using otoliths or other bony parts collected from wild fish for validation. If there is substantial overlap in body size among three-, four-, and five-year-old fish, then there may be considerable reabsorption of the scales from older fish. Since otoliths are not reabsorbed, comparing age determinations from otoliths and scales from a sample of four-year-old and older wild fish would improve their validation technique.

1c1) Has the applicant justified the selection of research, pilot or demonstration project, or a full-scale implementation project? This is clearly a research project.

1c2) Is the project likely to generate information that can be used to inform future decision making? Yes. The San Joaquin escapement estimates provide nearly 60 years of baseline information on the chinook salmon populations in the Central Valley. If the scale samples collected over the last 20 years indicate that length-frequency analyses can be used to segregate the escapement estimates into cohorts, then the entire 60-year database can be used to assess limiting factors and restoration projects. If not, then this project will provide a 20-year database that should be useful for judging the effectiveness of restoration projects.

2a) Are the monitoring and information assessment plans adequate to assess the outcome of the project? Yes with one exception. The QA/QC program should be adequate to assess the accuracy of the age determinations. This includes an analysis of the variation in the work of individual DFG scale readers and between DFG readers, and deviations in the work of DFG readers from the work of outside experts. However, the test of the primary hypothesis, which would compare the age determinations from the scale reading with the existing age determinations based on length-frequency analyses, was not described. It should be a simple matter to make this comparison in the final report.

2b) Are data collection, data management, data analysis, and reporting plans well-described, scientifically sound and adequate to meet the proposed objectives? Yes, with two exceptions. A database is proposed to organize the data and produce the summary tables, the statistical tests were identified, and the report contents were adequately described. However, there is no mention of how the age determinations will be used to reconstruct the cohorts. This is particularly important when there is considerable overlap in body size between the different ages. Usually computer software programs are used to estimate cohort sizes. Another issue is that the ability to accurately read fish scales oftentimes depends on the shape, preparation, and mounting of the fish scale. Abnormally shaped, dirty, or poorly mounted scales oftentimes produce incorrect age determinations and these features should be recorded in the database along with each age determination. Then if abnormally shaped or dirty samples are correlated with inaccurate age determinations, those samples can be omitted from the final cohort analysis. It may also improve the analysis to identify which scales were read by each reader to determine whether differences in the shape or preparation of the sample affected the age determination. Acetate impressions of scales are typically used to provide clean mounts of scales that can be easily marked to identify the scales used for age determination. Instead, the proposal indicates that scales will be cleaned and then mounted on glass slides.

3) Is the proposed work likely to be technically feasible? Yes. Although it may not be possible to accurately determine the age from every scale sample, the results will certainly be more accurate than the current estimates.

4) Is the proposed project team qualified to efficiently and effectively implement the proposed project? The qualifications section focuses on Tim Heyne, who will apparently supervise this project. However, most of the readers will be DFG Scientific Aides that will be trained for one month and then expected to exceed a certain percent repeatability on scale reference collections and accurately read the known-age CWT samples. The proposal does not indicate the minimum acceptable level of precision and accuracy of the scale readers nor does it discuss the criteria to be used to screen out unacceptable results for the final analysis.

**Overall Evaluation
Summary Rating**

- Excellent
- Very Good
- Good
- Fair
- Poor

Provide a brief explanation of your summary rating

The proposal is high quality except for a few deficiencies that can be easily corrected and the project will generate important information.