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MEMORANDUM

TO: ISAB
Erik Merrill, NPCC

FROM: Michele DeHart

DATE: November 19, 2010

RE: Response to ISAB Review Comments on the DRAFT 2010 Comparative Survival Study, Annual Status Report

The Comparative Survival Study Oversight Committee (Committee) has reviewed and addressed each of the Independent Science Advisory Board (ISAB) comments on the DRAFT CSS status report for 2010. The ISAB review comment is repeated in **bold** font, followed with the Committee response to the specific comment. The Committee also responded to other review comments, which resulted in some changes from the draft report. Specifically a chapter 8 conclusion was added and an executive summary was added. Analyses were also added in response to review comments. The ISAB comments and responses will be posted on the FPC web site and will also be included in an appendix to the status report.

Once again we found the ISAB comments to be constructive and helpful, improving the final product, annual report.

In addition to the general review comments, and the miscellaneous comments, the CSS also received a commented pdf file of the entire draft CSS 2010 report from the ISAB. All of the comments from the pdf file were incorporated or addressed in the report and no response from the CSS was necessary. The general review comments and miscellaneous comments are as follows:

1. General Review Comments

Overall, the presentation is well organized and well refined. An overarching comment is that connections with larger ecological concerns are not apparent. That is, there appear to be opportunities to involve researchers working on studies of other species, food webs, physiology, contaminants, and disease. Such combined studies might give added insights into mechanisms causing the observed temporal patterns in migration and survival.

Response:

We have taken advantage of the opportunity to involve other researchers from a variety of backgrounds. Specifically, the Comparative Survival Study (CSS) Oversight Committee convened a workshop in February 2004 on the effects of hydrosystem configuration and operation on salmon and steelhead survival. The workshop was attended by 17 scientists who have studied hydrosystem effects at a wide range of spatial/temporal scales and levels of organization. The organizing structure for the workshop took the form of a series of hierarchical impact hypothesis diagrams designed to represent an increasingly more detailed set of hypotheses about possible mechanisms for differential survival. This provided a clear framework within which workshop participants were asked to evaluate varied hypotheses relating to delayed mortality, and to evaluate the strength of evidence for and against these hypotheses. A final report was produced from this work (Marmorek at al. 2004). The CSS Oversight Committee is currently outlining plans for a future workshop organized in a similar fashion to consider updated hypotheses, research and analyses.

Marmorek, D.R., M. Porter , I.J. Parnell and C. Peters, eds. 2004. Comparative Survival Study Workshop, February 11–13, 2004; Bonneville Hot Springs Resort. Report compiled and edited by ESSA Technologies Ltd., Vancouver, B.C. for Fish Passage Center, Portland, OR and the US Fish and Wildlife Service, Vancouver, WA. 137 pp. (http://www.fpc.org/documents/CSS/CSSworkshop_reportfinal.pdf)

Inclusion of a list of acronyms would help many readers.

Response:

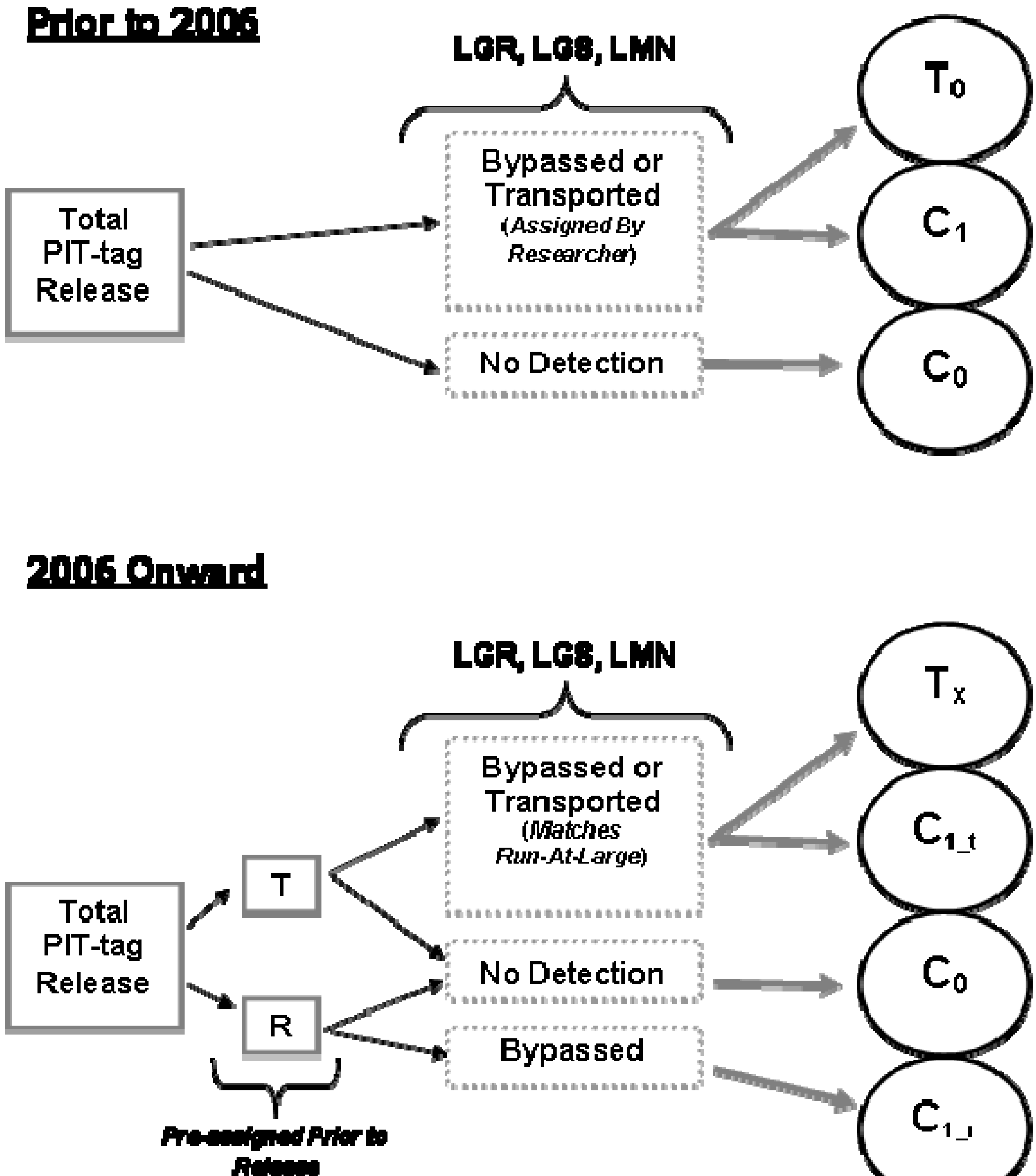
A Glossary has been added to define acronyms used in the report.

Chapter 1

The description of how the differently marked cohorts are used to translate into SARs and TIRs is valuable and much appreciated. Including a graphic/schematic would make it easier for the reader to understand this complex material. The use of differently marked cohorts reappears in Chapter 4 and the need for visuals is even greater there. This is an important procedural change, and clarity could be improved by including a general visual here and perhaps two to three more visuals in Chapter 4, where the detail is mathematically dense.

Response:

A schematic (shown below) was added to the description of the CSS study groups in Chapter 4 to help show the relation of the three study categories between the years prior to and during the pre-assignment of tags to monitor-mode and bypass-mode operations at the Snake River dams with collection and transportation facilities. In the years prior to pre-assignment of tags, the separation-by-code electronics at the dams kept track of the CSS tag groups and systematically routed one of every two (for 50% routing) or two of every three (for 67% routing) marked CSS smolts collected to transportation. In years with pre-assigned tags, the separation-by-code electronics only needed to keep track of the CSS monitor-mode assigned tags, and route those tagged smolts to raceways whenever transportation was occurring, since the fish pre-assigned to bypass-mode automatically followed the PIT-tag default return-to-river routing. Since pre-assignment operations at the dams only affect those smolts detected at LGR, LGS, and/or LMN, the undetected C_0 smolts are reflective of the run-at-large and may be estimated from the combination of Groups T and R, just as in years prior to pre-assignment. Detected smolts from Group T will produce the T_X and C_{1t} smolts reflective of the run-at-large smolts and along with the C_0 smolts will be used in Chapter 4 in the estimation of category specific SARs, TIR, and *D*. Detected C_{1r} smolts from Group R are reflective of continuous bypass of collected smolts over the entire season and along with the C_0 smolts will be used in the bypass meta analysis of Chapter 7.



Figures 1.2 and 1.3 could be made clearer by highlighting Release and Detection sites. The figures contain much detail so the main points of the figures may not be obvious. Table 1.1 is very instructive. It would also be useful if the numbers of fish used in the CSS were noted as an approximate fraction of releases from the basin and from above

Lower Granite Dam (LGR). That is, what percentage of all PIT tag releases above LGR is due to CSS?

Response:

> **Figures 1.2 and 1.3 include the major Chinook hatcheries (but not all their release sites) with the longest time-series in the CSS along with locations of large trap operations for wild fish. We will consider adding more maps to future reports however, in our opinion highlighting locations beyond what is already shown in the map legend and plotted symbols would make a map that is "too busy" and even harder to interpret.**
>
> **The section entitled "Coordination and pre-assignments in 2010" provides the current magnitude of tagging specifically done with CSS funds and the number of tagged smolts of other entities that participate with the CSS in the pre-assignment of their tagged fish into monitor-mode and bypass-mode groups. Calculating a percentage of CSS tags among all PIT tags released above LGR would not be useful as suggested by the ISAB and could result in confusion. It is inappropriate to simply divide the total pre-assigned smolts being used in the CSS by the total of all tagged spring/summer Chinook and steelhead in the basin above LGR. Studies that need to estimate tributary-specific survival rates to LGR on parr, pre-smolts, or smolts typically do not have extra fish available for pre-assignment to monitor-mode, and so would not be considered for inclusion in creating Groups T and R in the CSS. Likewise, all Chinook, steelhead, and sockeye released above LGR and detected at LGR along with wild Chinook and wild steelhead PIT-tagged by NOAA and returned-to-river at LGR were used in estimating LGR-MCN and MCN-BON reach survival rates for temporal blocks across years in Chapter 3. In that particular analysis although 100% of all fish released above LGR were potential candidates, only those detected at LGR are useable.**

If pre-release PIT tag loss is monitored at hatcheries (page 15) how is PIT tag loss assessed post-release?

Response:

> **By the time the hatchery releases of PIT tags are being obtained from the PTAGIS database, the tagging organizations have completed removing most if not all of the pre-release mortalities from the tag files located on PTAGIS. They do this by dotting out the tag code in the tag file and resubmitting an updated tag file to PTAGIS. We do not attempt to create any tag-loss adjustment, and rely on the updated tag files being final.**

It is not clear how much design work goes into pre-assigning stocks to be PIT tagged. CSS appears to play a major role, but it is not clear if this is a formal or ad hoc role.

Response:

> **FPC staff performs the randomization of hatchery Chinook for Dworshak, Rapid River, Catherine Creek, Imnaha, and McCall hatcheries; hatchery steelhead released above LGR for Dworshak, Clearwater, Hagerman, Magic Valley, Niagara Springs, Irrigon, and Lyons Ferry hatcheries; and wild Chinook and steelhead from those organizations participating with the CSS in allowing their fish to be pre-assigned into monitor-mode and bypass-mode groups. All hatchery smolts are initially pre-assigned based on the tag file prior to release, with final release group tag codes and numbers determined after pre-release mortalities and lost tags are dotted out of the tag file. Wild spring/summer Chinook and summer steelhead tagged from the summer and fall of the prior year and tag codes within the clip files planned for use during the spring migration season are randomly assigned into monitor-mode and bypass-mode groups by FPC staff. The actual released wild Chinook and steelhead from these existing tag files and clip files form the final pre-assigned monitor-mode and bypass-mode groups. The random selection has been performed on each tag in each population of interest using EXCEL's random number generation for bernoulli distribution with set probability P of assigning a particular tag code to the monitor-mode Group T and probability (1-P) of assigning that tag code to the bypass-mode Group R. PIT-tags for other IDFG Chinook hatcheries and the Nez Perce tribal trap on the lower Imnaha River are randomly assigned to monitor-mode and bypass-modes by the respective organization. Our study design and pre-assignment protocol in regards to meeting study goals is outlined in Appendix B of the 2008 CSS annual report entitled, "CSS Planned PIT-tagging Activity for 2009 and Assessment of Sample Size Requirements." (http://www.fpc.org/documents/CSS/2008%20CSS%20Annual%20Report%20--Final.pdf)**

Chapter 2

The figures and tables in Chapter 2 are clear and informative.

It may be beyond the scope of this chapter to include statistical analyses, but many of the stated results could be subjected to statistical tests. For example, more specific conclusions could be made as to the actual trends observed such as in 2008 and 2009 compared with the long-term average, between hatchery and wild, and among release groups, rather than a qualitative assessment of the trends. The discussion in chapter 2 is appropriately brief if no statistical tests are to be developed for this chapter. It is not clear whether inclusion of statistical testing has been considered and rejected in this chapter.

Response:

> **The intent of this chapter was to update and provide a time-series of annual juvenile metrics in management oriented groups. A consistent time-series of these metrics is important to inform research, management, and evaluation of these stocks. These metrics included juvenile reach survival, emigration rates, and descriptive plots of timing of PIT tag detections at FCRPS dams. The descriptive yearly temporal trends of PIT tag detections are meant to give context and provide more extensive background for other metrics provided for these stocks throughout this report. Statistical tests of temporal trends of PIT tag detections, in our opinion, would not further extend the usefulness of this chapter and were not considered.**

Chapter 3

Akaike's Information Criterion (AIC) was used to evaluate model fit and select best-fit models. The report states (p. 57) that "the best fitting models (based on AICc) for mean FTT, [and also for mean Z, reported in the following paragraph] consistently had model forms with Julian day, water transit time and spill." The number of surface passage structures was also included in some models. These findings are incompletely described, and thus the basis for selecting best-fit models is unclear. AICc, delta AICc, R2, and P-values for alternative models are not reported, nor are the results of model averaging. The relative contributions of the different variables to model fit are not shown. This information may have been omitted for the sake of brevity, but should be reported in future years as the database continues to grow.

Response:

> **Goodness of fit summary statistics for alternative model forms were not included in the draft for sake of brevity. We intend to report such statistics in future years as the database continues to grow.**

Predicted values for Z and FTT in the LGR-BON reach deviated considerably from observed values in some years (Fig 3.1, wild and hatchery Chinook salmon 2008-2009; Fig. 3.3, steelhead, aggregate hatchery and wild, 2004-2009). Discussion of hypotheses that might help explain these instances would be useful to provide context for the results.

Response:

> **Figures 3.1 and 3.3 do not address Fish Travel Time (FTT) or instantaneous mortality (Z) in the Lower Granite to Bonneville river reach. These figures address these migration parameters for the Lower Granite to McNary river**

reach. Although there are some deviations between the observed FTT and the predicted values for Chinook and steelhead during the first three early-season weekly groups, overall the models captured 83-92% of the variability in the migration rates. Similarly, although there were some deviations between observed Z and the predicted values (mainly for the late-season release groups), overall the models captured 28-49% of the variation in Z. In the interest of maintaining an empirically-based, objective approach to the data analysis, we have declined to speculate on hypotheses for these deviations. We will continue to exam the data in an attempt to better understand migration parameters, along with deviations between observations and predicted responses, when those occur.

Chapter 4

This chapter focuses on the primary objective of the CSS to estimate and compare smolt-to-adult return rates of juveniles passing LGR and returning to LGR as adults and post-hydrosystem survival rates of juveniles passing BON and returning to LGR for both in-river migrating and transported juvenile salmonids. The narrative is extremely careful and explicit with much attention paid to ensuring fair comparisons and to describing the difficulty of what was done to ensure fair comparisons. It would be useful to include flow charts to assist the reader through the adjustments and record keeping described in the narrative.

Response:

The schematic shown in response to Chapter 1 has been added to the methods section of Chapter 4 to help show the relation of the three study categories between the years prior to and during the pre-assignment of tags to monitor-mode and bypass-mode operations at the Snake River dams with collection and transportation facilities.

Standard tagging and detection practice has changed over the years, which has both allowed and necessitated changes in the way various constructs are calculated. Statistical methods for the CSS study have been modified and refined over time and are adequately described in this chapter on pages 67 through 75. SARs, TIRs, and D-values are reported (pages 76-92) in detailed tables and graphs for all study years, as in past annual reports. It would be useful to summarize how to compare these redefined constructs/estimates over time and changing procedures with earlier estimates. Were the earlier estimates approximately correct or systematically off? The procedures, and the attendant estimation methods, will continue to improve, but we will always need to be able to compare over time and across methods. An evaluation of the current state of progress is needed.

Response:

The CSS bootstrap program was overhauled in 2008 to handle the PIT-tagged smolts pre-assigned prior to release to Group T (monitor-mode) and Group R (bypass-mode) beginning with the 2006 smolt migration year for wild and hatchery Chinook and wild steelhead. In the 2008 and 2009 CSS Annual Reports, the 2006 and 2007 migration year data was handled identically as in past years by simply combining the Group T and R smolt together (i.e., forming Group CRT) before estimating the SARs for the transport T_0, in-river C_0, and in-river C_1 categories. For the 2010 CSS Annual Report, we transitioned to applying only Group T data to estimation of SARs for the transport (T_X) and in-river C_1 categories, while retaining the combined CRT group for estimation of SARs for the in-river C_0 category. This is possible since smolts undetected at the three Snake River collector dams in both Groups T and R equally reflect the untagged run-at-large, and when combined provide a larger sample of smolts and returning adults, thus improving the precision of sar(C_0) estimates. A comparison of the transport SARs, in-river C_0 SARs, TIR, and D estimated for smolt migration year 2006 in the 2009 and 2010 CSS annual reports are presented in the following table. Only this set of data is comparable since 2006 data in Annual Report 2008 and 2007 data in Annual Report 2009 have incomplete adult returns. This table shows that the effect of the change to using T_X smolts (transport histories 200, 020, 120, 002, 012, 102, and 112, where 2 is transported, 1 is bypassed, 0 is undetected, and digit order is LGR-LGS-LMN) from Group T versus T_0 smolts (transport histories 200, 020, and 002) from Group CRT was relatively small for smolt migration year 2006. The small differences in sar(C_0) between the two reports were due to some smolt capture history updates made in the overall 2006 smolt migration year database. The wild steelhead sar(C_0) would also have been 1.37% as in the 2009 annual report if not for the one 3-salt return available for the 2010 annual report. Therefore, the 2009 Annual Report's transport SARs, in-river C_0 SARs, TIR, and D for smolt migration year 2006, the first-year of the pre-assignment approach, were approximately correct.

CSS Annual Report ➔	Estimates for smolt migration year 2006							
	AR2009	AR2010	AR2009	AR2010	AR2009	AR2010	AR2009	AR2010
Parameter ➔ Group➔	sar(T_0) CRT	sar(T_X) T	sar(C_0) CRT	sar(C_0) CRT	TIR	TIR	D	D
WCH	0.77%	0.76%	0.97%	0.97%	0.79	0.78	0.48	0.47
RAPH	0.58%	0.57%	0.42%	0.42%	1.37	1.35	0.85	0.83
DWOR	0.35%	0.36%	0.39%	0.38%	0.90	0.95	0.57	0.60
CATH	0.41%	0.45%	0.92%	0.93%	0.45	0.48	0.23	0.26
MCCA	1.16%	1.15%	1.03%	1.04%	1.12	1.11	0.75	0.74
IMNA	0.77%	0.77%	1.25%	1.25%	0.62	0.62	0.36	0.36

WST	1.34%	1.31%	1.37%	1.54%[A]	0.98	0.85	0.60	0.52
HST [B]	2.13%	2.14%	1.42%	1.42%	1.49	1.50	0.98	1.01

[A] One returning 3-salt wild steelhead added in Annual Report 2010.
[B] No pre-assignment for hatchery steelhead, so transported T_X fish also from Group CRT.

The in-river C_1 SARs were calculated separately for Groups T and R in Annual Report 2010, with the Group T results which reflect the untagged run-at-large presented in Chapter 4 and the Group R results which reflect bypassing collected smolts over the entire season being presented in the meta analysis of Chapter 7. In both cases, the estimated smolt numbers are computed using the expectation equations since survival rate and capture probability parameters are computed using Group CRT data and then passed to groups T and R where each respective estimate of C_1 smolts is computed. The sar(C_1) estimate presented in the 2009 annual report is akin to a proportional weighted average of the group specific SARs and is approximately correct in that context. However, the estimation of separate C1 SARs for groups T and R have more utility from a management perspective.

CSS Annual Report ➔	Estimates for smolt migration year 2006				
	AR2009	AR2010			
Parameter ➔ Group➔	sar(C_1) CRT	sar(EC_1) T	Proportion C_1 in T	sar(EC_1) R	Proportion C_1 in R
WCH	0.51%	0.36%	0.314	0.57%	0.686
RAPH	0.33%	0.19%	0.204	0.37%	0.796
DWOR	0.20%	0.19%	0.350	0.21%	0.650
CATH	0.44%	[no adults]	0.155	0.54%	0.845
MCCA	0.67%	0.77%	0.173	0.66%	0.827
IMNA	0.48%	0.40%	0.240	0.50%	0.760
WST	0.64%	0.60%	0.414	0.66%	0.586
HST (no pre-assignment)	1.23%	1.23% (same estimate of sar(C_1) from CRT)			

When part of the CSS bootstrap program overhaul in 2008, the expansion to LGR equivalents of removals below LMN in the estimation of smolt numbers in categories C_0 and C_1 was updated to use estimated reach survival rates from LGR to MCN, JDA, or BON for removals at these respective dams instead of the original 50% rate applied to the sum of removals across MCN, JDA, and BON. This program modification was recommended in the BPA review of the 2006 CSS Annual Report. As shown in our response to the BPA comment (see pages 165-166 in Berggren et al. 2006) as well as the Table below, this change results in negligible changes in estimated SARs in the pre-2003 years. Out of 43 PIT-tag release groups from 1994 to 2002, there were only 16 with smolt numbers changing by more than 0.5% from the original to updated computer program,

and of these, only one group exceeded a 2.5% change (i.e., 1994 wild Chinook changed 10-11%). The updated bootstrap program has been applied to all Snake River smolt migrations starting 2003 in the 2008, 2009, and 2010 CSS annual reports.

Group	Category C_0			Category C_1		
	Smolt Est. Pct. Change	Reported SAR	Updated SAR	Smolt Est. Pct. Change	Reported SAR	Updated SAR
WCH1994	**– 11.10%**	**0.28%**	**0.31%**	**– 10.07%**	**0.07%**	**0.08%**
WST 1998	1.07%	1.07%	1.06%	1.36%	0.21%	0.21%
RAPH2000	0.70%	1.59%	1.58%	0.82%	1.33%	1.32%
MCCA2000	0.82%	2.06%	2.04%	0.58%	2.03%	2.02%
DWOR2000	0.52%	1.01%	1.00%	0.57%	0.81%	0.81%
RAPH2001				– 1.21%	0.050%	0.051%
MCCA2001				– 1.73%	0.039%	0.039%
DWOR2001				– 2.46%	0.042%	0.043%
HST2001				– 1.35%	0.016%	0.016%
WST2001				– 0.64%	0.067%	0.068%
WCH2002	0.60%	1.22%	1.22%	0.55%	0.99%	0.98%
RAPH2002	1.07%	0.67%	0.66%	1.33%	0.63%	0.62%
MCCA2002	0.91%	1.03%	1.02%	1.03%	1.02%	1.01%
IMNA2002	0.75%	0.45%	0.45%	0.82%	0.55%	0.54%
DWOR2002	0.90%	0.50%	0.50%	1.22%	0.50%	0.49%
CATH2002	0.78%	0.49%	0.49%	0.83%	0.32%	0.32%

Much of the detailed data previously included in the appendices of the CSS reports is now available only on the FPC website. This seems to be a good idea, but the data accessible on the FPC site has not been updated to include the two most recent years of completed adult returns.

Response:

FPC staff is in the process of updating the WEB tables of juvenile reach survival rate estimates, adult returns by age group, and smolt numbers by study category.

The very useful summary at the end of the chapter conveys the larger perspective quite well.

Chapter 5

It is agreed that, as stated in the methods, "the use of fish detected upstream that were not detected at BON to estimate BON efficiency was the best available measurement of this parameter." As the authors noted, "this nominal estimator of efficiency could have been inaccurate if fish passed BON undetected and through straying/harvest/mortality were never again detected. This problem was alleviated by comparing these two rates in a fraction (*e.g.*, Success(TX or T0)/Success(Cx). The assumption here was that the rate for passing BON undetected and never being detected again was the same for the transported and in-river fish. Since the fish were from the same species/hatchery, the assumption seemed reasonable." However, although the approach used may be the best available, it may not be a very good assumption. Transported fish may be more likely to stray into intervening tributaries and not be detected again.

Response:

We have re-calculated the efficiency at Bonneville dam using the Manly-Parr model (Amstrup et al. 2005; pages 46-55) which precludes any assumptions about undetected fish and updated the final report to include this approach. By using the Manly-Parr model to calculate efficiency, the approach is clearer for the reader and avoids any potential biases.

Using Manly-Parr, the efficiency estimate is based on the sample of fish passing BOA and surviving to be detected at upstream sites (i.e., is conditioned on upstream detection). While we can only estimate BOA detection efficiency based on those fish surviving to upstream sites, it is not built on an assumption of 100% survival. Rather, estimating detection efficiency in this way only assumes that survival and detection probability are equivalent for all individuals (i.e. detected and undetected fish survive at a similar rate); the number of fish actually detected at BOA and upstream sites (i.e., 'sampled') will thus vary as a function of survival, but the estimate will not.

To maximize the sample for these estimates we calculated efficiency using the pooled transport and in-river adults. But first for comparison, we calculated efficiency for both transported and in-river groups separately and compared. Of 69 cases, only four showed a statistical difference in the efficiency estimate between transported and in-river fish.

Amstrup, S. C, T. L McDonald, and B. F.J Manly. Handbook of capture-recapture analysis. Princeton Univ Pr, 2005. (pg 46-55).

It is also not clear in this section how fall-backs are handled (i.e., those adults that pass upriver and subsequently fall back downriver). They may have been dealt with adequately, but some clarification of how those fish were handled would be useful in this section. Is there evidence that transported fish fall-back more or less frequently than in-river fish?

Response:

> **For the analyses in this chapter, adults that are detected in the ladder are considered ascending adults and their subsequent successful or unsuccessful migration to Lower Granite as adults is the metric measured. This is compared across in-river and transported study categories to measure the effects of transportation on subsequent adult return through the hydrosystem. The detections of adults decrease at upriver sites as a result of the combination of straying, harvest mortality and passage mortality. Since adults may pass BON and later fallback, this is also included in this parameter. We have added language in the methods to clarify this point.**
>
> **An analysis of fallback and presumably any re-ascending is a different analysis than was shown in this chapter. This chapter has addressed a differential in straying rates between transported and in-river groups. The CSS has not addressed any potential fallback differential between in-river and transported groups at this point.**

In the introduction to this chapter, the point was made that best practice is to tag the smolt at the source, rather than at LGR, because of losses of LGR-tagged fish. That also means we should be able to determine the survival rate from the source (with some allowance for handling problems and initial mortality) to LGR. That is not reported here.

Response:

> **The loss between marking location and LGR is reported as part of this report and is available on the fpc website (www.fpc.org; see Chapter 4 for instructions on website use). However, particularly for the wild groups which have a portion of fish marked in the fall before outmigration and a portion marked during the spring outmigration, this may be difficult to interpret. This parameter is mostly useful in estimating a PIT tag population at LGR during the outmigration. Nonetheless, the focus of this chapter was on return rates, straying, and other adult issues whereas juvenile survival is covered in detail in chapters 2,3, and 4.**
>
> **The Snake River basin fish used in SAR estimation were PIT-tagged and released in tributaries and mainstem locations upstream from LGR reservoir. Other investigators (Sanford and Smith 2002; Paulsen and Fisher 2005; Budy and Schaller 2007) have used detection information from smolts released both above LGR and at LGR for their estimates of SARs. Because all Snake River spring/summer Chinook must pass through LGR reservoir, we believe that smolts released upstream from LGR most closely reflect the impacts of the**

Lower Snake and Columbia River hydrosystem on the untagged run-at-large in-river migrating fish. The C_0 group may only include smolts released above LGR, since it is defined as those fish that remained in-river while migrating past the three Snake River collector dams undetected. Fish collected and marked at LGR do not have a similar experience. Additionally, the documented bias in SARs (i.e., reduction in estimated survival rates) for groups marked at LGR is another reason for only using PIT-tagged fish released upstream of LGR in SAR calculations for this analysis.

It also means that we have the potential (or at least the need) to examine return success from LGR, back to source, though detection capability at (or closer to) the source would be needed. It would be useful in future efforts to obtain good estimates of the source to LGR and LGR to the source components.

Response:

This parameter was presented in Chapter 5 of the CSS 2005 annual report. There were difficulties generating robust estimates of adult survival above LGR. In that chapter most of the survival estimates from LGR to the hatchery were below 60%. The Imnaha PIT-tag data were excluded from this analysis because adults typically pass the weir site before installation. In other cases, there were multiple factors that could resulted in low numbers of PIT-tagged adults detected at the hatchery rack for these estimates: (1) unaccounted adults spawning below weirs and trapping sites; (2) adults overshooting the trapping sites during periods when weirs are not installed; (3) straying into other streams; (4) missed detections of PIT-tagged adults or shed tags at the hatchery; (5) under-reporting of harvest; (6) delayed mortality from hooking and handling these fish in fisheries; and (7) high natural mortality of adults after passing upstream through the hydrosystem. For these reasons we did attempt a similar analysis in this report.

Chapter 6

This chapter is generally well written. The results provide an informative summary of the long term SARs. It also provides a useful comparison and discussion of differences in SARs calculated through run reconstruction and the CSS PIT tag project, as suggested by ISAB/ISRP review. This discussion is important because of the potential bias in both methods. Further exploration and resolution will be necessary before the full utility of the information is clear; some clarification and care in this section could be a useful step in that direction.

On page 130 L. 2-4 the report states that “it was unclear whether a bias existed in either the run reconstruction or PIT tag SARs due, in part, to uncertainties and assumptions in the run reconstruction methods.” Clarifying that both methods, not just RR methods, are subject to uncertainties and assumptions, would help. In L. 15-17 the report states “…SARs did not appear to be predominantly due to differences in juvenile abundance estimation methods” and cites Tuomikoski et al., 2009 on “similarities” in abundance estimates used in both cases. It would be useful to at least briefly consider the nature of the “similarities” and the uncertainty in both estimates to demonstrate the magnitude of the potential bias from this source.

Response:

> **We clarified that both RR and PIT methods are subject to uncertainties and assumptions. We cited the CSS 2009 report (Tuomikoski et al. 2009), which compared the annual smolt estimates using RR and CSS methods. The geometric mean of smolt abundance using the Copeland et al. RR method was 4% higher than the CSS method (Tuomikoski et al. 2009).**
>
> **Similarity means the estimates as well as methodology were relatively similar for juvenile abundance. The CSS 2009 method and Copeland et al. (2008) both used daily samples of wild yearling spring/summer Chinook smolts from the smolt monitoring program at Lower Granite Dam. Both methods expanded collection estimates of wild smolts to a daily population estimate based on estimated PIT-tag detection probabilities, and then summed those daily estimates across the season for an annual estimate.**
>
> **The difference between the CSS 2009 method, and the Copeland et al. (2008) method was that the CSS juvenile population estimate incorporated a variance estimate for both the smolt collection and the daily juvenile population estimate and then incorporated those variance estimates into the annual smolt population estimate.**
>
> **In Tuomikoski et al. 2009 we stated …”by incorporating the uncertainty in the collection sample, we derived SARs with confidence intervals that were in most cases wider than those reported by Copeland et al. (2008). We believe that incorporating both sources of error (i.e., error due to detection probability and error due to the collection sample) provides a better sense of overall uncertainty in the estimates of juvenile population abundance for use in run-at-large SARs.”**

On Page 131 L.5-23 and page 131 L. 24-46 and page 132 L. 1-38 the report outlines and explores the possible sources of bias in both methods. Although these are very important observations, the discussion of potential bias is much more fully developed in the run reconstruction section than the PIT tag section. Comparable development that sheds some light on the potential magnitude of different sources, or possible methods for exploring, the PIT tag bias would be very useful and would help balance the perspectives. By example in the discussion the potential bias due to non-representative marking of steelhead is invoked as a possible explanation for a lack of correlation between wild and hatchery stocks. Those observations could be used to consider the nature of that source of bias in this section.

Response:

> **We expanded the section of potential bias in PIT tag SARs with additional literature citations and discussion.**

Chapter 7

The overall objective for this chapter is to improve understanding of the effects of bypass systems on Chinook salmon and steelhead. Three sets of analyses were conducted:

1) Evaluation of the effects of bypass systems on fish travel time from Lower Granite Dam to Bonneville Dam for fish that are detected in the bypass systems at Little Goose, Lower Monumental, McNary or John Day dams relative to fish that are not detected at those dams.

2) Evaluation of the effects of bypass history on SARs from Bonneville Dam outmigration to Bonneville Dam. Within this analysis two questions were explored. The first was whether multiple bypass experiences negatively affected post-Bonneville Dam SARs. The second question was whether there was evidence that bypass at particular dams was more harmful than others.

3) Evaluation of whether the cumulative effects of bypassing smolts at dams results in increased mortality expressed in SARs by using a random effects meta-analysis.

The chapter contains much detailed information about methods for modeling bypass systems. That said, there is much supporting and background material that has not been included. A more complete review of this chapter is warranted, perhaps in combination with an overall examination of the regional bypass evaluation efforts. The caveats stated in this chapter that caution should be used when interpreting route-specific survival estimates and SARs conditioned on bypass detection provide support for a careful, independent review of the complexity of the data, modeling, and interpretation of results.

Response:

As with all of the analyses associated with the CSS and the CSS Oversight Committee, review is welcome and the CSS study has benefited from the extensive review that has occurred to date. The CSS Oversight Committee and the sponsoring state, federal and tribal fishery management agencies regard the delayed effects of bypass passage as a key concern for future analyses and consideration. The CSS Oversight Committee is committed to continue, enhance and improve the future analysis of delayed mortality associated with bypass passage.

In Table 7.2 it may be useful to show non-significant estimates as well to provide an overview of general tendencies.

Response:

The intention of Table 7.2 was to show the overall tendency of delay associated with bypass passage when an effect of bypass passage was significant. Non-significant estimates were excluded from the table to enhance clarity and avoid confusion.

The use of Box-Cox to select a transformation to reduce the influence of right skewed distributions should be reconsidered. The Box-Cox method is primarily designed to identify transformations that can address heterogeneity of variances, not problems with normality. Using the reciprocal transformation of FTT in Chapter 7 while using the more conventional log transformation of FTT in Chapter 3 deserves justification.

Response:

According to Krebs (1989), Sokal and Rohlf (1981) and many other references, Box-Cox transformations are used to both reduce heteroscedasticity and better approximate normality of residuals. We describe that for the individual, LGR-BON FTT data being analyzed in this chapter, the Box-Cox transformation results indicated that an inverse transformation was most appropriate. These data should not be confused with the weekly cohort estimates of mean LGR-MCN FTT and mean MCN-BON FTT analyzed in Chapter 3, wherein the Box-Cox transformation results indicated that a log transformation was most appropriate.

Krebs, C.J. 1989. Ecological Methodology. HarperCollins Publishers New York.
Sokal, R.R., and F.J. Rohlf. 1981. Biometry. W. H. Freeman and Company New York.

Miscellaneous editorial comments

All Miscellaneous editorial comments were addressed and changes were incorporated into the CSS 2010 final report except where noted by a response.

Chapter 1

p. 6, line 7. "…long term dataset of annual estimates of the survival rate of ~~annual~~ generations of salmon…"

p. 6, line 12. presumably not just Chinook salmon?

Response:

> **At its inception the CSS only included Chinook salmon; steelhead were added specifically in response to an ISAB review of the CSS (ISAB 1998-1).**

p. 6, line 27. Its' should be It's.

p. 6, line 34. "~~this~~ the 2010 annual report…"

p. 6, line 38. "~~This current~~ The 2010 annual report…"

p. 6, line 42. "This report ~~completes the~~ includes complete return data (i.e.,3-salt returns) from smolt migration year 2007…"

p. 6, line 42. (ISAB 2010) should be ISAB (2010)

p. 7, line 2. Suggest omitting "...are few, but..."

p. 7, lines 7-10. awkward sentence "Reductions in the number…"

p. 7, line 15. The caption for Figure 1.1 should define the acronyms used in the figure: SAR, TIR, S/S, AND R/S. (The acronyms S/S AND R/S appear unnecessary for this figure).

p. 9, Figure 1.3: Change caption to explain how this figure is different from the previous figure (appears to be a detailed version of just a subset of the Columbia River basin), and perhaps, why it has been included.

p. 10, line 1- DPS/ESU –what is DPS

p. 10, line 4. "…the caveat that ~~we have presented~~ our presentations of Snake River stocks ~~only above~~ do not include stocks below Lower Granite Dam~~;~~. Also,…as a Mid Columbia group,~~. This was for simplification as this was~~ partly for simplicity, as it is…upstream of Bonneville Dam."

p. 10, line 22. "For hatchery fish, low abundance was a concern as …". Meaning is unclear.

p. 10, line 33. "…, hatchery-reared fish are tagged…"

p. 10, line 37. "Recapture information can be collected without sacrificing ~~each~~ fish, and ~~lower impacts due to trapping and handling occur where~~ automated detection stations ~~exist~~ reduce impacts from trapping and handling."

p. 10, line 39. "~~The Columbia and Snake River Mainstem~~ PIT-tag detectors at ~~the~~ mainstem dams in the Columbia and Snake rivers now allow…"

p. 10, lines 42-46. Awkward sentence should be rewritten.

p. 12, line 2. "…information. This method is used to estimate survival of the total number of fish ~~estimated to~~ approaching…

p. 12, lines 4-5. meaning is unclear

p. 12, line 19. (change) CSS is also examines (to) CSS also examines

p. 13, line 14. "~~Estimates of~~ D ~~isolates~~ excludes mortality occuring during juvenile salmon passage ……dams ~~from~~ and captures any differences in mortality between transported smolts and in-river migrants that occur~~ring~~ ~~afterwards (during time~~ downstream of Bonneville Dam, in the ocean and upon returning upriver as adults to Lower Granite Dam ~~for transported smolts)~~."

p. 13, line 17. "~~When~~ D=1 ~~is equal to one it~~ indicates that there is no difference…" and similarly in subsequent sentences.

p. 13, line 28. "1. tagged fish that are detected and collected at Snake…LMN), and transported downstream of BON."

p. 13, line 39. ~~affects~~ affected

p. 14, line 37. Should explain (at least conceptually) how the number of C_0 smolts will be estimated

p. 15, line 19. (change) data is (to) data are

p. 15, lines 40-42. Not a complete sentence

p. 16, line 6. "…operation to reari~~ng~~ only stocks endemic to the Grande Ronde River basin ~~endemic stocks~~."

p. 16, line 17. "~~In coming years~~ With the greater coverage…separation of metrics…by basins should be possible in coming years.

p. 16, line 28. "~~Pre-release~~ Tag loss and mortality of PIT-tagged fish were monitored before release, and tagging…"

p. 16, lines 30-34. Does not make grammatical sense, as stated.

p. 17, line 1: "…to ~~affect cost savings and~~ avoid redundancy and save costs as …"

p. 17, line 15: "…Fish and Wildlife; …"

Tables 1.2 and 1.3: Define "Ch." and "St." in caption. Also, why are numbers aggregated for Ch./St.? Would it not be better to present the numbers separately for each species?

p. 20, line 7 "…had lower spill." Lower than what?

p. 20, line 8. "particularly unique". Unique is not a word that can be qualified. "Highly unusual" is more appropriate and more scientifically accurate.

p. 20, line 16. delete second "also"

p. 20, line 18. The sentence "The percentage of smolts transported in 2001, 2004, and 2005 were three years with the highest transportation percentages of CSS PIT-tagged wild fish." is grammatically incorrect and should be rewritten.

Figure 1.4. shows more than just the "average daily values" (title of chart). Presumably the box plots summarize the distribution of daily values, and a brief explanation in the caption seems warranted. Otherwise this is a very effective figure.

Chapter 2

p. 47. The statement that survival estimates are not stable should be clarified, perhaps by noting that estimated survival rates exceed 1.

Chapter 3

p. 52, lines 12-14. state "Due to sufficient numbers of PIT-tagged hatchery and wild yearling Chinook available, analyses in the LGR-MCN reach were conducted separately for hatchery and wild yearling Chinook....Analyses on the MCN-BON reach included hatchery and wild yearling Chinook and steelhead from the Snake River...."

Comments: (1) This reads as if separate analyses were done for hatchery and wild steelhead (as well as for hatchery and wild Chinook) in both the MCN-BON reach, but this is probably not the intended meaning. (2) In the following paragraphs on p. 52 and p. 53 it is made clear that hatchery and wild Chinook were in fact combined for analyses of fish travel time, survival, and instantaneous mortality in the MCN-BON reach, apparently contradicting the statement above (in lines 12-14). Minor rewording is needed to correct these problems.

Chapter 4

p. 70, lines 33-35: An assessment of how divergent C_0 and C_1 are under well estimated situations is needed along with a sense of the reliability of this and other combined estimates.

p. 71, line 2. Insert word "be": "...transport SARs have tended to [be] low (NOAA 2008)."

p. 73, lines 5-7: The reader needs a rough quantitative sense of how limited the contribution of jacks and mini-jacks is to spawning. The issue may become more relevant if the "jacking rate" increases, due to adaptive pressures in favor of early return.

Response:

> **Sentence regarding "limited contribution of jacks and mini-jacks to spawning" has been replaced with statement that SARs for each study category are computed without jacks, but in Chapter 6, wild and hatchery Chinook annual overall SARs are computed both with and without jacks.**

p. 74, lines 2-6: Confidence bands on any ratio are inevitably asymmetric. The material presented here is not clear in describing precisely how confidence bands were constructed. There are several possible alternatives. More explanation should be provided for clarity.

p. 76. Captions for Figure 4.1, Table 4.1 (and other figures and tables in this chapter) include the sentence "The transport SAR (Tx) after 2005 is a partial year metric because of the delay in transportation start date."

Comment: The delayed start to the transportation season after 2005 is adequately explained elsewhere in the text (in several places) and doesn't need to be repeated in figure and table captions. In addition, the phrase "partial year metric" is not an aid to understanding.

p. 79. The caption for Table 4.2 should be bolded to match the captions for other tables.

p. 88, line 4. Here (and elsewhere?) it would be best to describe the "break even" TIR to one decimal point rather than as an integer: i.e., as 1.0 rather than 1.

Chapter 5

p. 96, line 31. A verbal sense of the Chinook jack return (and its likely impact) would be good here, just for perspective.

p. 97, lines 9-10. A verbal sense of the 'near' equivalence of C_0 and C_1 would be good here, given that they will be averaged. It would also be good to provide some numeric sense of the range of $BON_{efficiency}$ here.

p. 97, lines 19-21. Given accumulating information to the effect that transported fish are more prone to stray than are in-river migrants, is this a reasonable assumption? Straying and non-detection are not the same thing, but are straying fish as likely to remain undetected as those that do not stray?

p. 97, lines 30-32. The material presented here is not clear in describing precisely how confidence bands were constructed and there are several possible alternatives. More explanation should be provided for clarity.

p. 99, lines 1-2. Why a *t*-test, particularly, given the logit modeling?

p. 99, lines 25-26. Where/what is BOA?

p. 104, lines 12, 22, 29. These sentences are difficult to interpret. Perhaps a revision such as:

". . . models in the set for wild Chinook was 100% (transport), 100% (spill), 47% (LGR. marking), 25% (temperature), respectively."

There appears to be one more number than categories.

p. 104, lines 42-46. The text is grammatically awkward and would benefit from revision.

p. 105, line 38. "drop-out rate"

Chapter 6

p. 117, line 12. “achieving overall SARs (including jacks) in the…”

p. 117, lines 25-26: “…take actions to improve the likelihood that Columbia River salmon can survive varying ocean conditions.” Is the intention to take actions to improve ocean survival based on predictions of ocean conditions that will be experienced or to compensate for poor survival after the fact by reducing mortality during the return migration (e.g., from fishing, passage)?

Response:

> **The language was from NPCC (2009; Section IV, Primary Strategy, p. 60). The CSS-OC interprets the language to mean that actions need to be taken in freshwater to ensure population persistence and to meet Program objectives in the face of varying ocean conditions. The primary actions in the Program to date have been focused on tributary spawning/rearing, and mainstem and migration habitats.**

p. 118, lines 15-19. The meaning is not clear here. Is the point simply that more and different adult accounting locations would be required to assess performance if the objective is to achieve a particular distribution of adult spawners in the basin rather than just a total number of spawners?

p. 118, lines 37-38. If the SAR target includes jacks but most analyses exclude jacks, it would be worth indicating how much those analyses underestimate SAR relative to the target. In other words, indicate the typical difference between SARs including jacks and SARs excluding jacks.

Table 6.1 indicates SARs of wild Snake River Chinook, including jacks, average about 7.5% greater than SARs excluding jacks.

p. 119, line 5. Define or explain “Group TWS”; it does not appear to be defined elsewhere in the report.

p. 119, line 8. What are “the two methods”?

p. 119, line 16-17. This section is awkward, seeming to mix a study, a plan, and a company as subjects coordinating efforts.

p. 119, line 40. ~~For both Snake and Columbia River basin PIT-tag salmonid populations,~~ Non-parametric 90% confidence intervals are computed around the estimated annual overall SARs for PIT-tagged populations in both the Snake and Columbia rivers.

p. 120, line 14. The subscript in t_j should be fixed.

p. 120, line 19. Define S_j

p. 120, line 24 (or soon thereafter). Indicate (at least conceptually) how C_0 will be estimated.

p. 121, line 19: "…fewer parameters (than was the case before 2006) need to be estimated during intermediate steps before arriving at the final annual overall ~~annual~~ SAR estimate ~~as occurred in pre-2006 years~~.

p. 121, line 20. "In these cases," meaning under the new approach?

p. 121, line 21. "in this group" meaning group T?

p. 121, lines 36-42 and continued next page. Run on sentence is difficult to understand.

p. 122, line 5. "…run reconstruction (RR) of…"

p. 122, line 10. "…we ~~continued~~ extended from 1998-2004 to 1994-2008 the comparison of SARs based on PIT tags and ~~run reconstruction (~~RR ~~hereafter), 1998-2004~~, examined SAR methodologies and…"

p. 123, line 10. "…only a single migration year (1999)…". What about 2008? Seems inconsistent with Table 6.1 and Figure 6.2.

p. 123, line 21. "Catherine Creek hatchery spring Chinook…"

p. 123, line 28. "…trends in the overall SARs (LGR-GRA) of wild and hatchery Snake River Chinook groups were similar and highly correlated…"

p. 124, line 12. "…correlated (0.70) during the 1964-2007 period when aligned by smolt migration year."

p. 125, lines 24-26. Is the implication here that the final estimates based on complete returns of B-run stocks may yet exceed the 2% target?

<u>Response:</u>

Two ocean adults are the predominant saltwater age for B-run steelhead (e.g., Marmorek et al. 1998 Table B.3-3); therefore a 2% or higher SAR would be plausible from smolt migration year 2008.

p. 127, line 38. “No PIT-tag SARs have been compiled for hatchery steelhead populations in the mid-Columbia region.” It is not clear whether the effort has not yet been made or whether the requisite data unavailable.

<u>Response:</u>

The CSS-OC has not yet investigated the potential.

p. 129, line 8. “…however, ~~with~~ creating greater uncertainty in the SAR estimates ~~compared to~~ here than in the Snake River.”

p. 132, line 32. “…inflating average SARs for cohorts that experienced low survival…” Errors in age composition would presumably produce the opposite bias in cohorts with good survival.

p. 133, lines 28-30. Unclear why the high correlation makes continuing the time series important. Is it because hatchery fish could be used as a proxy for wild fish in years when wild fish are too scarce to obtain reliable SAR estimates?

<u>Response:</u>

Sentence modified to indicate “hatchery SARs will be important to augment wild Chinook SAR information in future years of low tag return numbers of wild adults…”

p. 133, lines 31-37. Consider revising to avoid awkward sentence construction.

p. 134, line 23. “…with IDFG run reconstruction SARs for the period 1996-2004, ~~with both time series indicating~~ and SARs from both time series were well short of…”

p. 134, line 37. “…implementing an independent basin-wide ~~independent~~ study of PIT-tag bias ~~study in an effort~~ to evaluate and test…”

p. 135, line 9. “…ocean ~~can suggest which~~ could reveal factors ~~will be~~ that are most critical to survival, and thus ~~provide data as to~~ which actions taken inland ~~will~~ could provide…” Also, regarding uncertainty in meaning, see comment for page 117, lines 25-26.

p. 135, lines 16-22. Consider revising the awkward start of the paragraph. Perhaps it would be better to say: “Additional comparisons of PIT-tag data within seasons suggest that shared environmental factors are influencing mortality rates of both [indicate which species…original sentence says only the two species]. Mortality rates in both species were positively correlated (1) during freshwater outmigration…”

p. 135, line 26. "…a promising ~~line~~ direction of inquiry for upcoming CSS study ~~direction~~. We plan to ~~explore evaluating~~ evaluate the correlation ~~for~~ of SARs among the regions."

Chapter 7

p. 161, line 7. Replace "we" with "when".

p. 180 and following. Footnotes for migration year 2008 on Tables B.1 through B.5 should refer to "B" not "A".