FISH PASSAGE CENTER

847 NE 19th Avenue, #250, Portland, OR 97232
Phone: (503) 833-3900 Fax: (503) 232-1259
www.fpc.org/
e-mail us at fpcstaff@fpc.org

MEMORANDUM

TO: FPAC

FROM: Jerry McCann

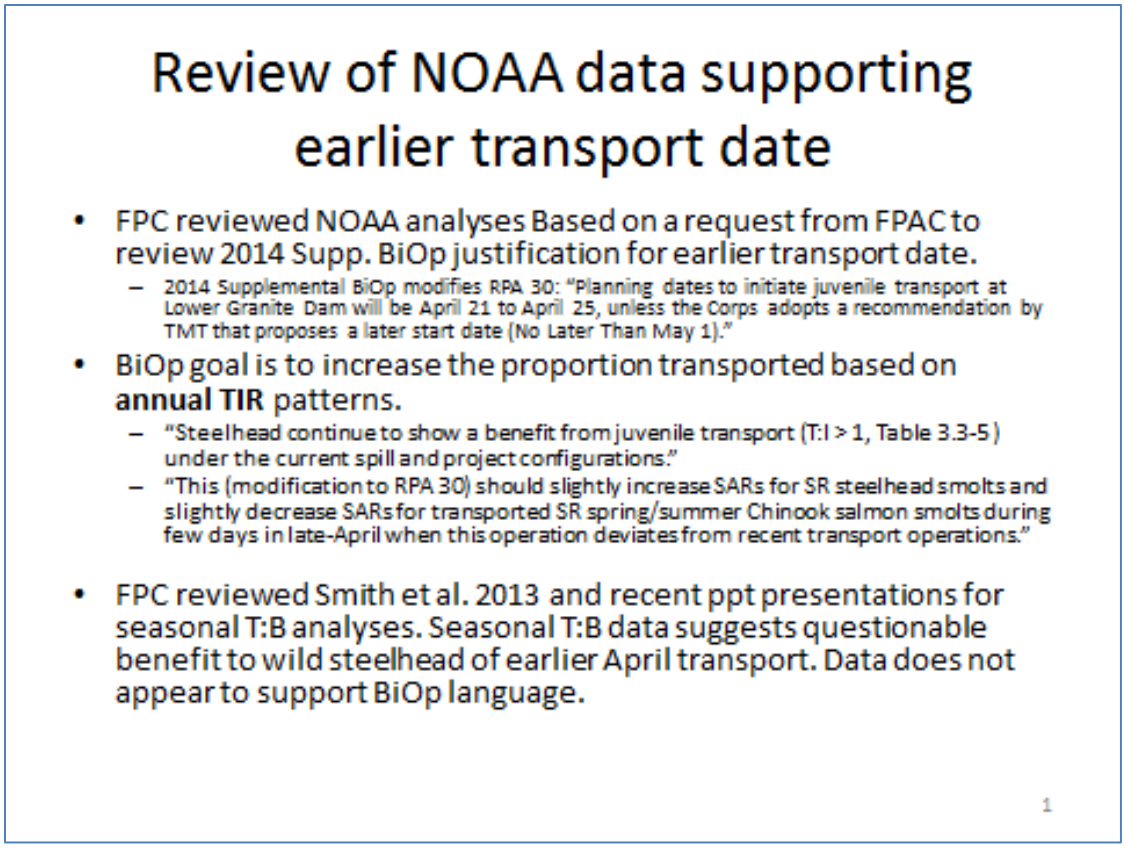
DATE: February 18, 2014

RE: Review of NOAA analyses supporting modification of RPA 30 -- earlier transport in April

Based on a request from FPAC the Fish Passage Center staff reviewed NOAA documents related to the April earlier start date of smolt transportation and modification of RPA 30 as included in the 2014 BIOP. The following summarizes our review conclusions. The slides and discussion were presented at the February 18, 2014, Fish Passage Advisory Committee meeting and are included for your reference.

- Although we have serious reservations about the approach used, the NOAA data do not appear to support the earlier start data of smolt transportation for wild yearling Chinook, hatchery Chinook, and hatchery steelhead in April.
- The data for wild steelhead is sparse and ambiguous, and does not support the proposed earlier April start date of smolt transportation. Overall the NOAA analyses do not show a convincing survival benefit for the proposed earlier date of smolt transportation.

The following slides and discussion, presented to FPAC on February 18, 2014, are included for reference.

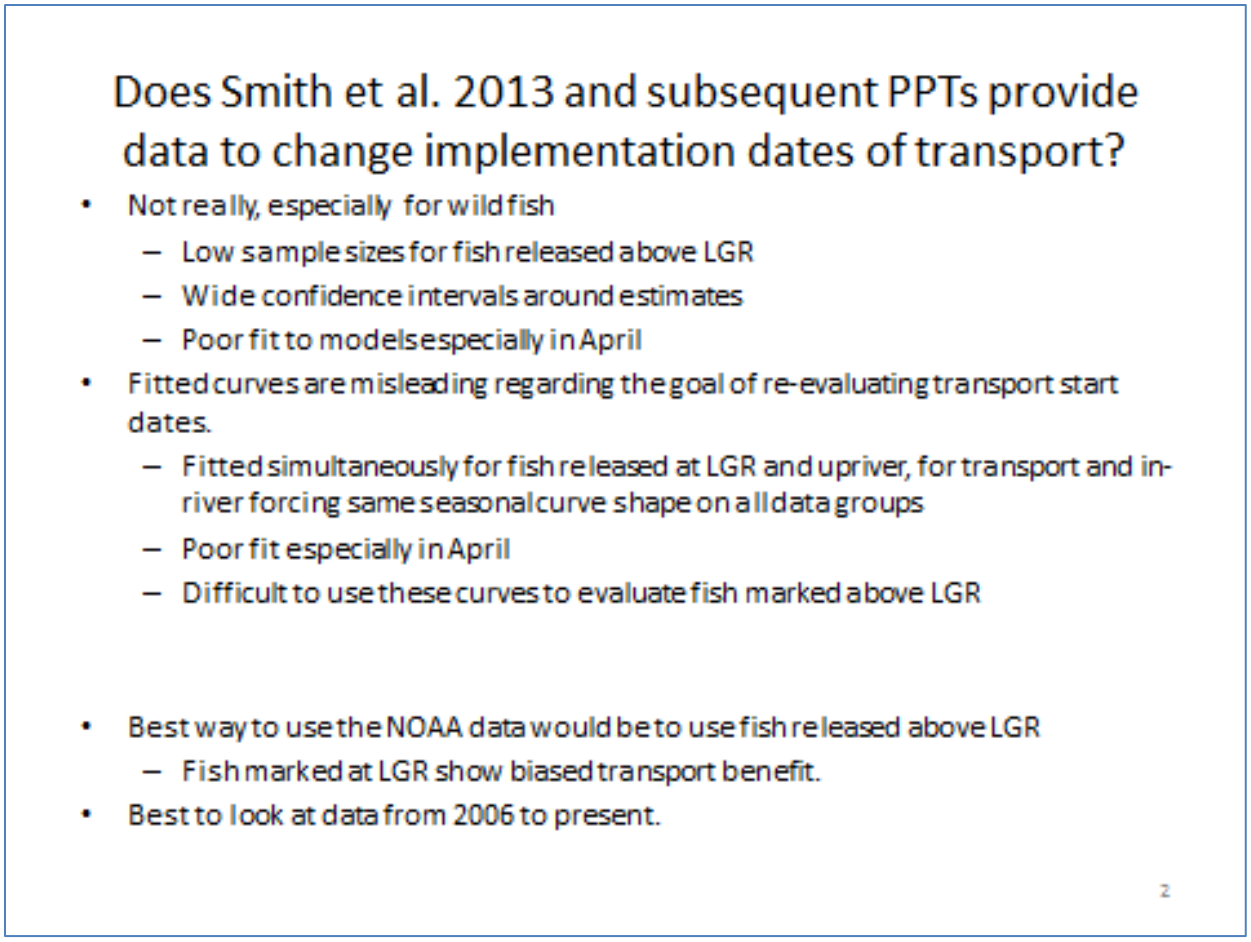


Slide 1. FPC was requested to review the data NOAA has presented as justification for recommending an earlier transport date in the 2014 Supplemental Biological Opinion (BiOp). The 2014 Supplemental BiOp modifies RPA 30: "Planning dates to initiate juvenile transport at Lower Granite Dam will be April 21 to April 25, unless the Corps adopts a recommendation by TMT that proposes a later start date (No Later Than May 1)."

According to the BiOp the objective is to increase the proportion transported based on **annual TIR** patterns. The BiOp states that "Steelhead continue to show a benefit from juvenile transport (T:I > 1, Table 3.3-5) under the current spill and project configurations…This should slightly increase SARs for SR steelhead smolts and slightly decrease SARs for transported SR spring/summer Chinook salmon smolts during few days in late-April when this operation deviates from recent transport operations."

Table 3.3-5 displays the annual TIRs which NOAA appears to be using to justify a change during a few days in late April. However, NOAA goes on to present seasonal SAR analyses as support for the proposed change and contradict the implication that TIRs are constant throughout the spring.

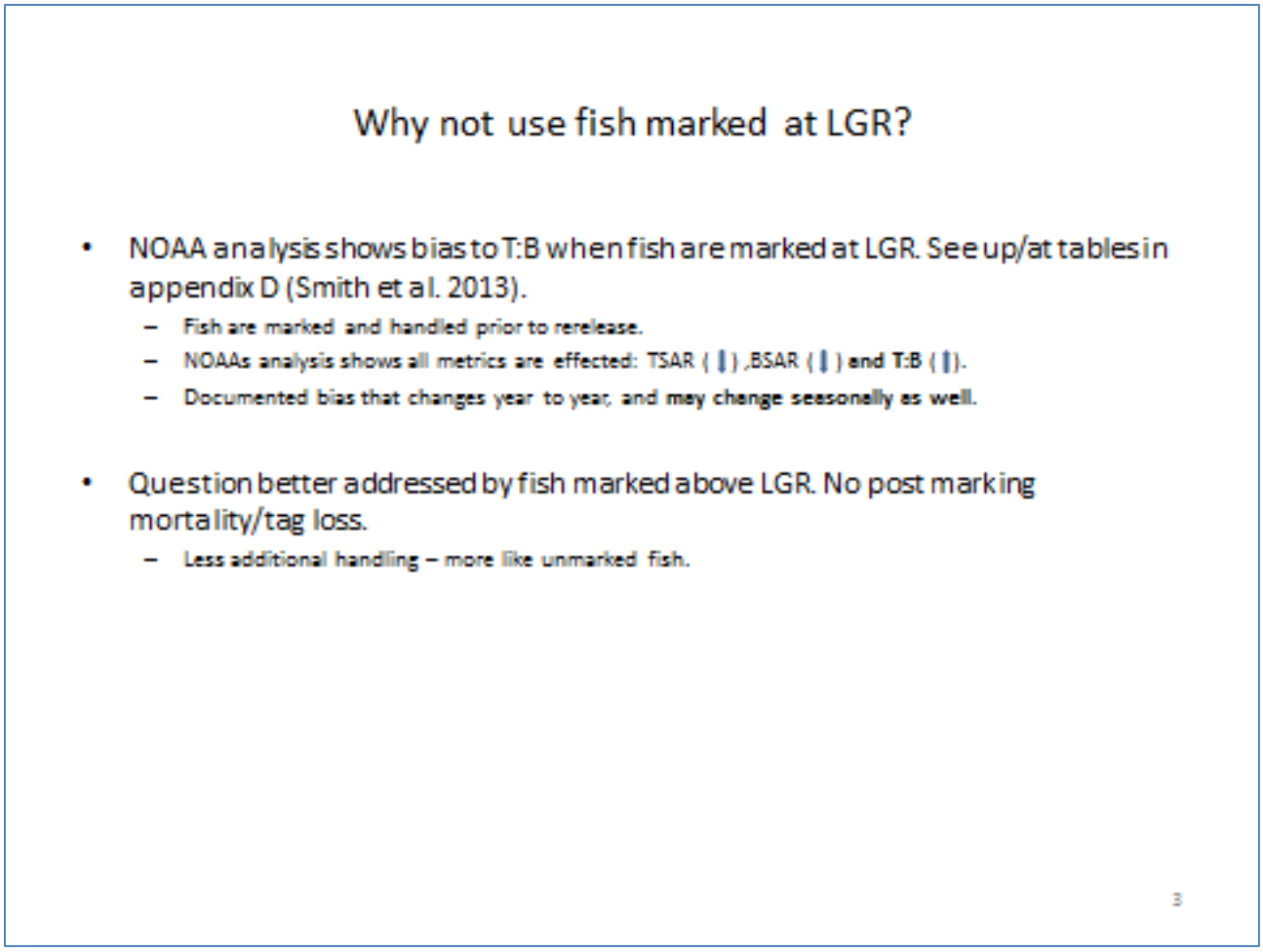
Our review of Smith et al. 2013 and recent PPT presentations by NOAA suggests that the benefit of earlier April transport for wild steelhead is questionable. And, the data NOAA has presented do not support the change as proposed in Supplemental BiOp.



Slide 2. We address whether the NOAA analysis provides data that justifies a change to the start dates for transportation as stated in the Supplemental BiOp. Based on our analysis we don't think so, and this is especially true for wild fish. This is in part due to the low sample sizes in detected groups (from releases above LGR), resulting in imprecise estimates of SARs and poor fits of modeled curves for these fish. The analyses should not be considered adequate for supporting this change.

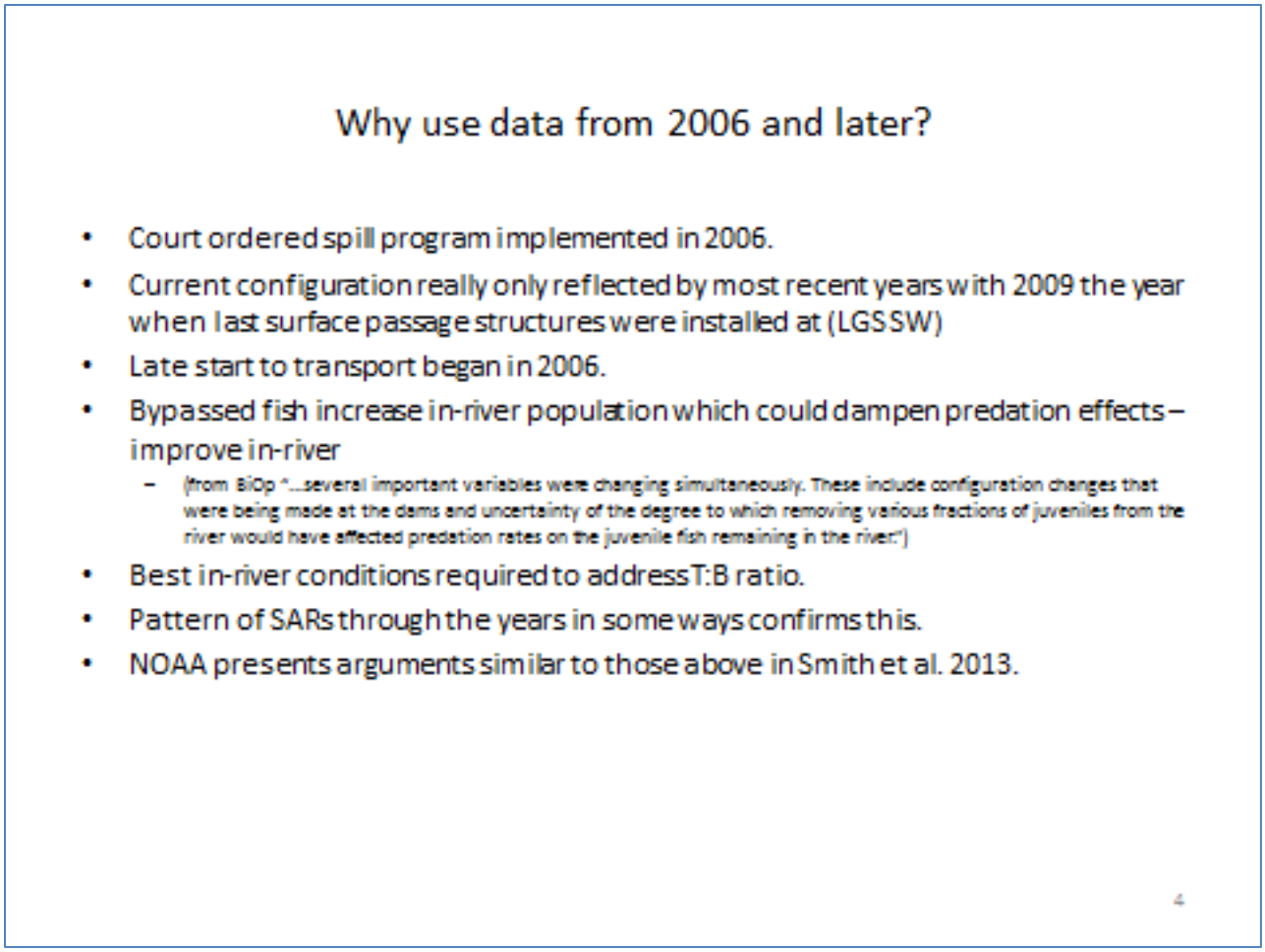
In subsequent slides we will show how the fitted curves used to populate the color graphs summarizing when there are significant or non-significant differences in transport and in-river SARs, are misleading when applied to wild fish marked above LGR. The poor fit is especially evident in April, the time when fewer upriver marks are available and estimates of SARs are most imprecise. NOAA acknowledged poor precision in their models especially in April and June in Smith et al. 2013 stating, "Further, in some cases the confidence bounds were very broad around the weekly *SAR* estimates and around the outputs from the Poisson models. Thus, information pertaining to the tails of the outmigration remains uncertain;…"

We suggest that the best way to view these in-season analyses NOAA has presented is to use data only from fish marked above Lower Granite Dam to avoid known bias to transport benefits of using fish marked at the dam. We also present information as to why it would be better to focus on data from 2006 and later, when in-river conditions most reflect the current operations and hydro-system configuration.

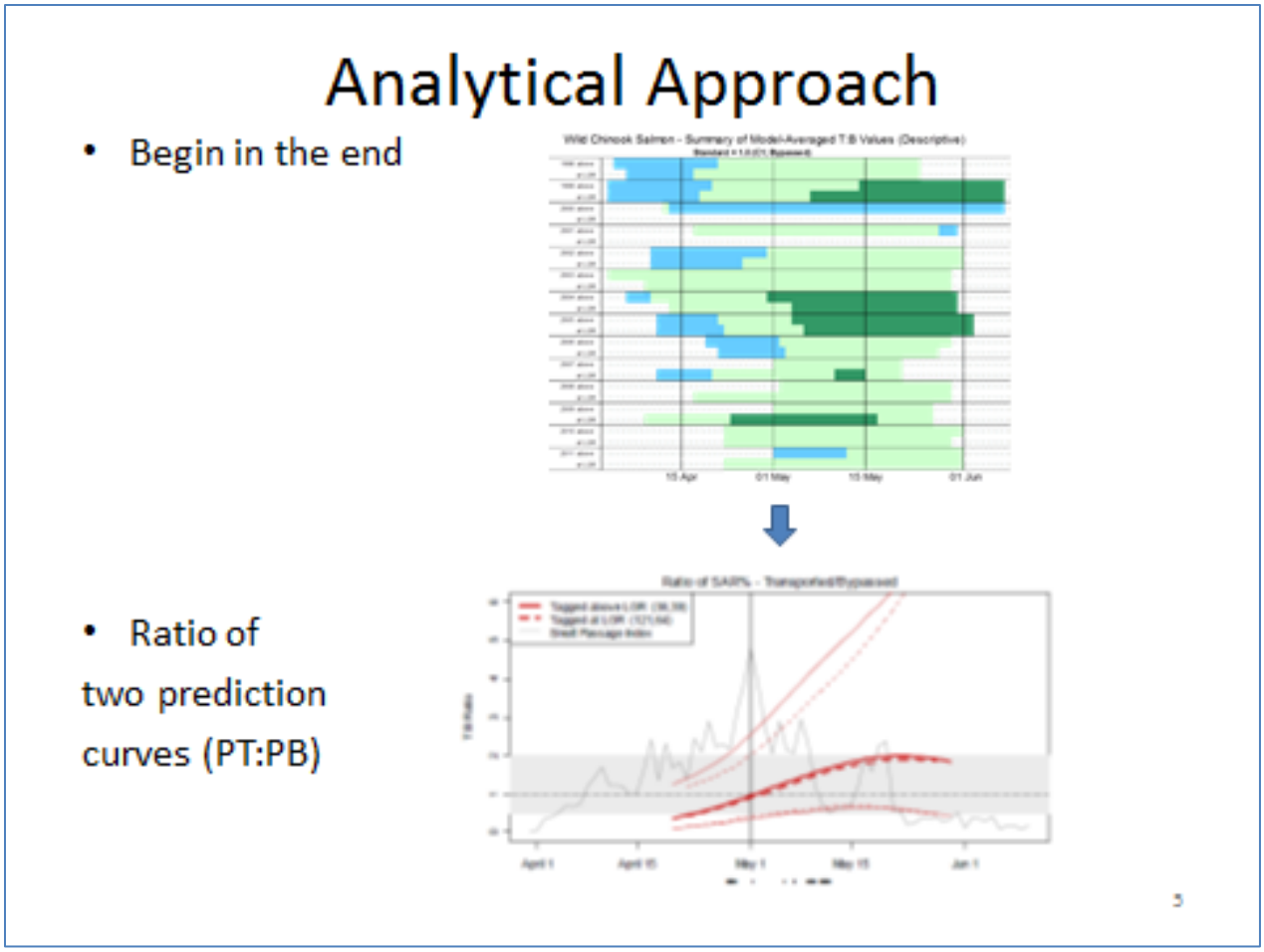


Slide 3. NOAA's analysis shows there is a bias to the calculated T:B ratios when using fish marked at LGR. Tables in Appendix D of Smith et al. 2013 show there is a clear bias to all SAR metrics when you compare the SARs derived from fish marked upstream of LGR and those marked at LGR. Transport SARs and Bypass SARS of fish marked at LGR are lower for fish marked at LGR. And, more importantly, the T:B or transport benefit is biased higher for fish marked at LGR. NOAA documents that the bias for marking at LGR varies from year to year, and it may also change seasonally, which would greatly confound the analyses they present.

Because of the documented bias from marking at LGR, it would be more appropriate to address this seasonal benefit issue using fish marked above LGR. Fish marked above LGR do not have the increased stress of additional handling and holding that LGR marked fish experience, and would better represent fish arriving at the dam.



Slide 4. As NOAA pointed out in Smith et al. 2013, the more recent years better represent conditions fish will experience under the current configuration and operation of the hydrosystem. Several structural and operational changes have occurred including: the implementation of court ordered spill operations beginning in 2006; the installation of surface passage structures that was completed in 2009; and the late start to transportation that was initiated in 2006. Together these actions have increased the in-river proportion of fish, which could have contributed to the relative improvement in in-river SARs evident in NOAA's analysis. NOAA suggested as much in the Supplemental BiOp when they wrote "…several important variables were changing simultaneously. These include configuration changes that were being made at the dams and uncertainty of the degree to which removing various fractions of juveniles from the river would have affected predation rates on the juvenile fish remaining in the river." It is important when evaluating a potential change to management that the best in-river conditions, and most representative conditions be used to compare transport to bypass SARs. Consequently, the years after 2006 would be most representative. To some extent the patterns in SARs that NOAA presents confirm this, showing a decreasing benefit to transport since 1998 for both steelhead and Chinook salmon.



Slide 5. Following is a brief review of the methods NOAA used to develop the color plots that NOAA has presented that summarize seasonal changes in the relative SAR rates of transported and bypassed fish.

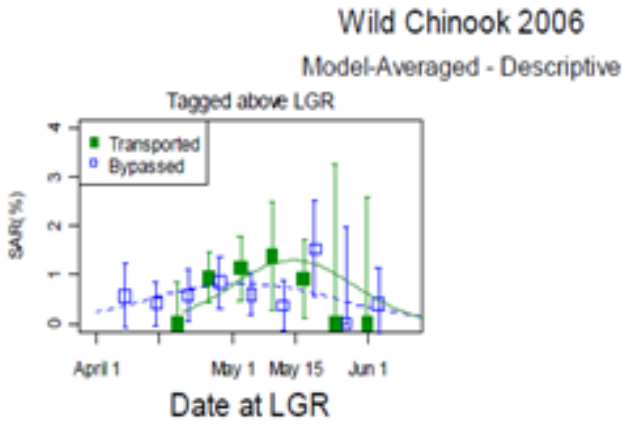
In the top figure light blue bars indicate time periods when in-river SARs are predicted to exceed transported SARs—but the in-river SAR is not statistically significantly higher. In that case the T:B or transport benefit is less than 1, or the ratio of the predicted TSAR over the predicted BSAR is below the 1 on the lower graph. In the lower graph the confidence intervals overlap 1 and so the predicted ratio is not significant. In the upper graph when the line goes above 1 (for the ratio of predicted predicted TSAR over predicted BSAR) then the bars are light green. When that predicted ratio is statistically significantly above 1 then the bars are shown as dark green.

In this instance the lower graph is for wild Chinook for 2006 and the curve crosses 1 on May 1.This is depicted in the upper garph as light blue prior to May 1 and light green after May 1.

So, the blues and greens are based on comparisons ratios of predicted SARs. And sometimes those predicted SARs, which are really prediction curves, don't fit the data very well.

Analytical Approach

- Two curves fitted for fish released above LGR?

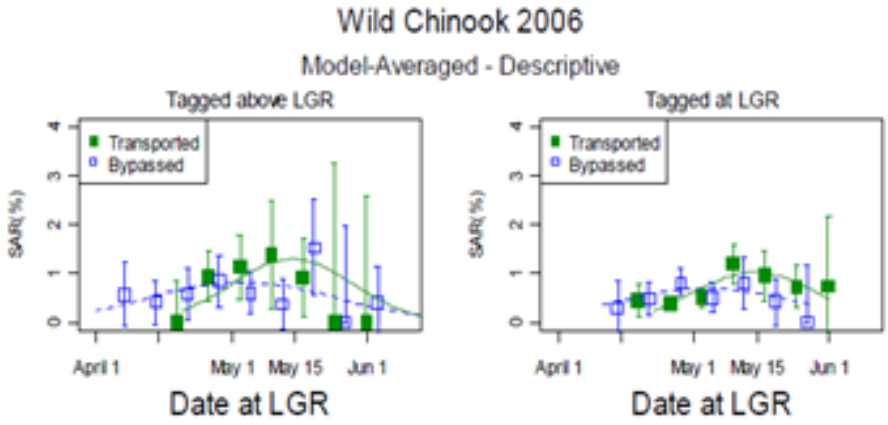


6

Slide 6. To illustrate how the bars and curves fit the data for wild Chinook in 2006 we reviewed the prediction curves and weekly SARs for wild Chinook marked above Lower Granite Dam. The blue boxes with error bars represent bypassed fish SARs, while the green boxes represent fish that are transported after arriving at LGR. What you see is that the prediction lines cross one near May 1, and that corresponds with the previous figure where the T:B ratio rises to 1 around May 1. However, on close inspection the curves don't appear to fit the data very well, especially in May. Indeed it looks as if, based on the comparison of weekly SARs that in the latter half of May, that the transport benefit should probably drop back below 1. The next step is to determine why the curve does not fit the data.

Analytical Approach

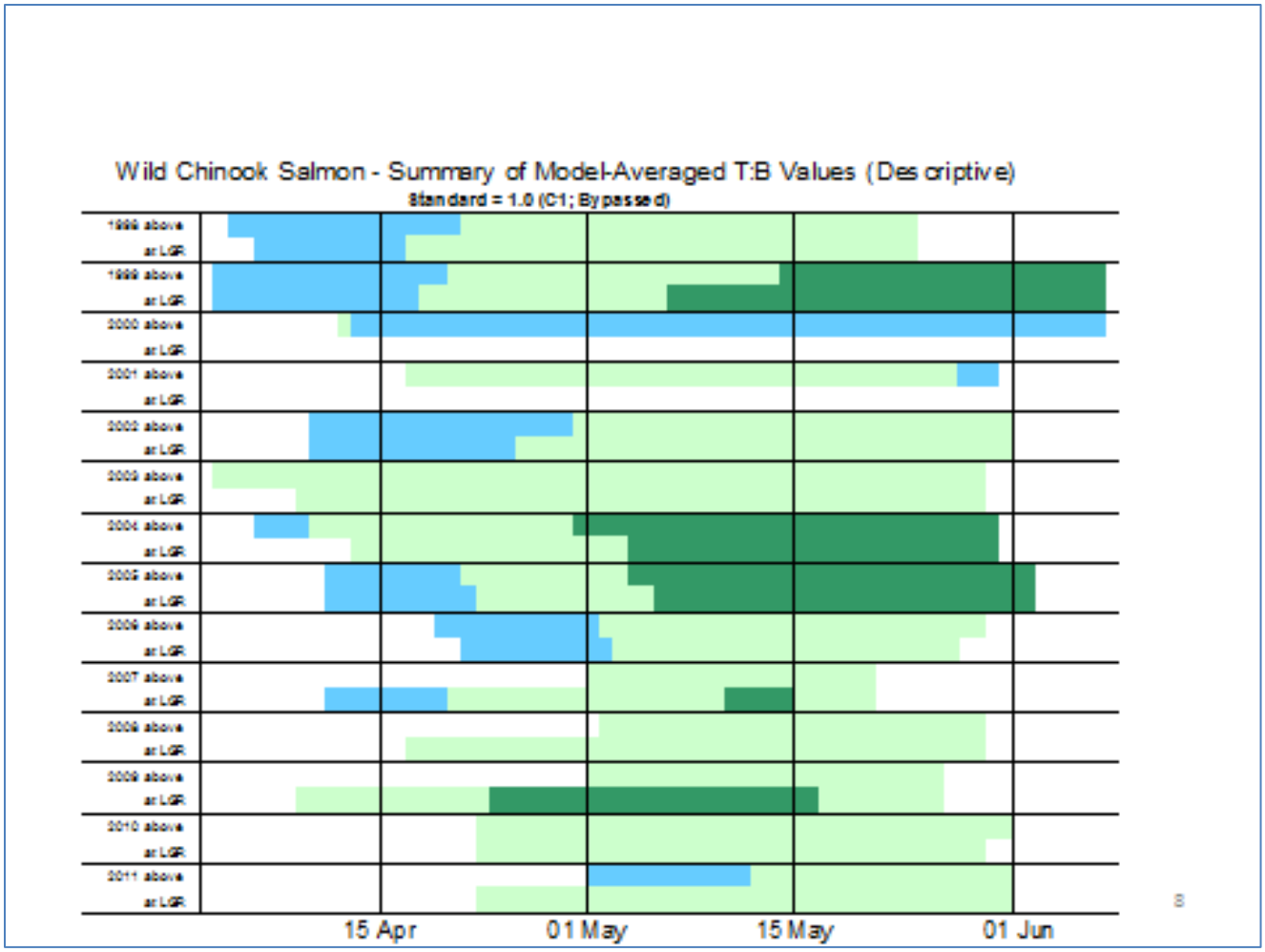
- Two curves fitted for fish released above LGR? But simultaneously fitted with data for fish released at LGR.



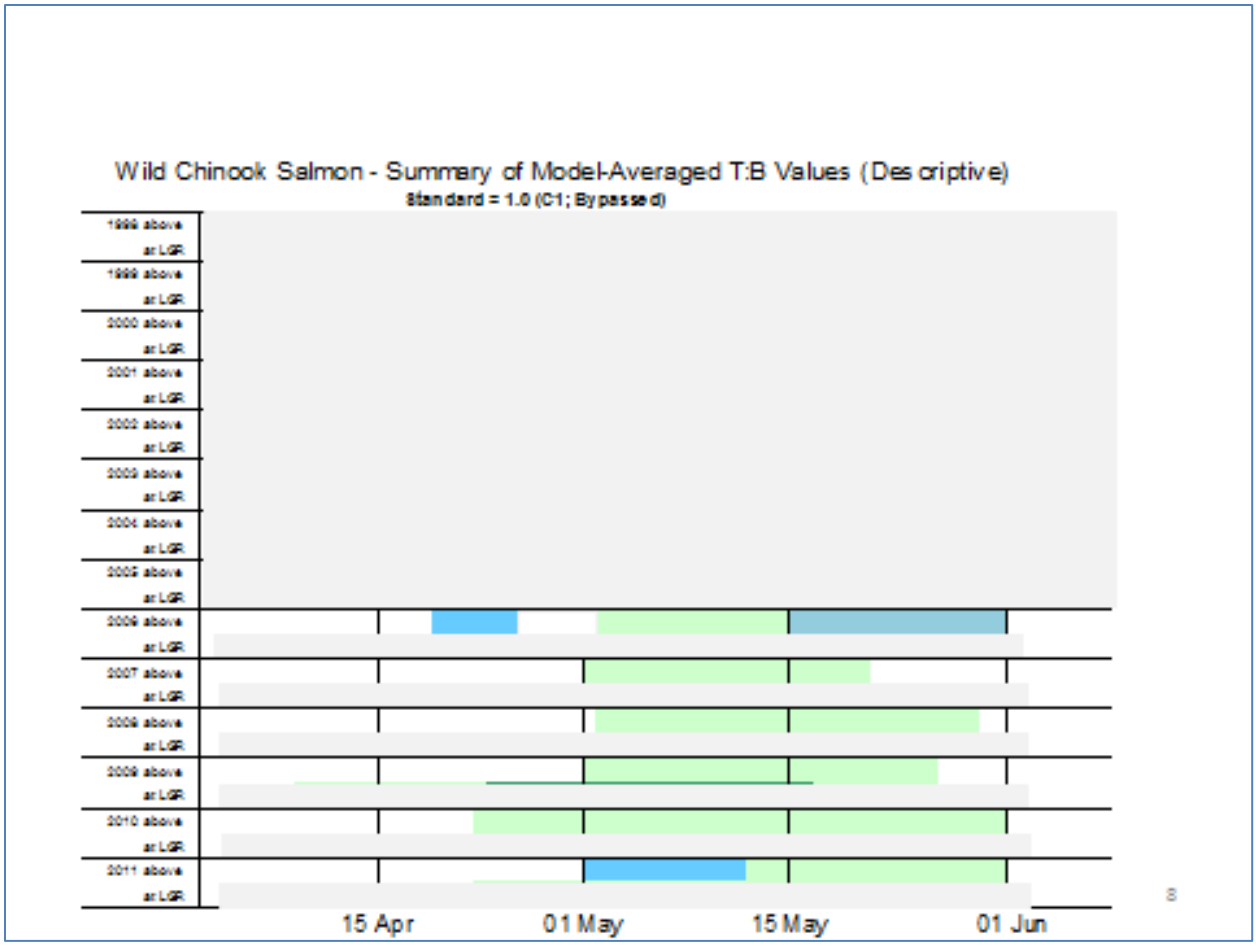
	Above	At
T	4,133 (36)	17,263 (121)
B	6,198 (39)	10,131 (64)

7

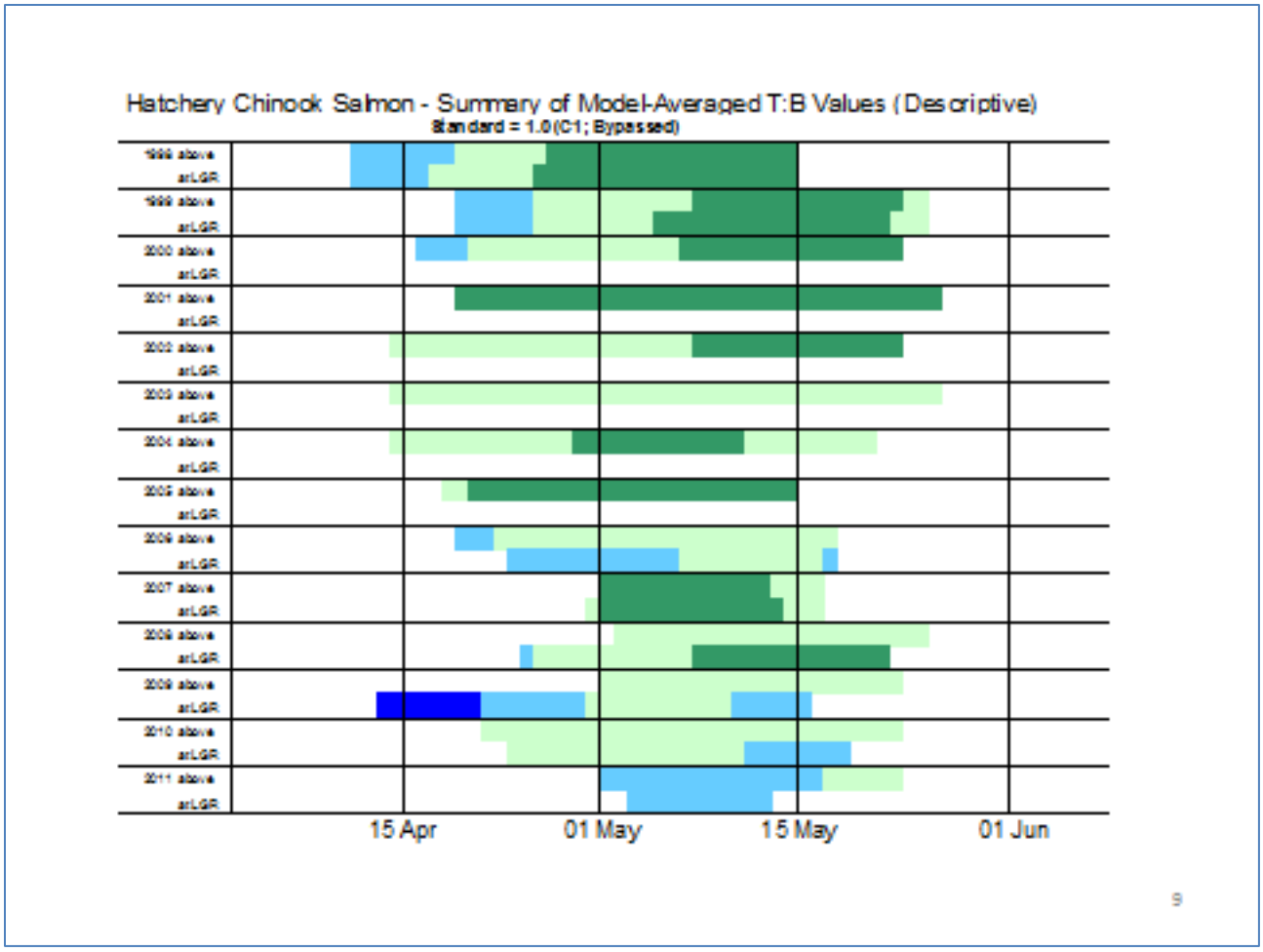
Slide 7. The curves don't fit the SARs of fish marked above LGR because the curves are actually fit simultaneously for both fish marked at LGR and fish marked above LGR. If you consider the curves on the right, the fish tagged at Lower Granite fit the data much better than the curves on the left for fish tagged above LGR. Notice that the confidence intervals for the SARs for fish tagged at LGR are generally much tighter due to the larger sample sizes available for those fish. Essentially the curves are weighted to the SARs for fish marked at LGR due to larger sample sizes and lower variances on those estimates (even though the regression used daily SAR estimates). From the table you can see that over 27,000 LGR marked fish were used in the regression compared to a little over 10,000 fish marked above LGR. Therefore, the prediction curves for the fish tagged above LGR are not representative of the data. The ratios of those prediction curves show transport benefits during all of May and June, when in fact the SAR data suggest otherwise. This is a result of the regression model that uses all of the data at once, and assigns dummy variables for tag location and transport. This means that whatever group or groups have the most precise estimates (i.e., largest tag groups) will determine the seasonal shape of the curves. In the years compared, the prediction curves were weighted toward LGR marks and so were often not useful for capturing the seasonal SAR patterns accurately. Thus the predicted T:B ratios were not representative. This was true for the wild fish where smaller sample sizes for fish marked above LGR meant greater weight on the LGR marks.



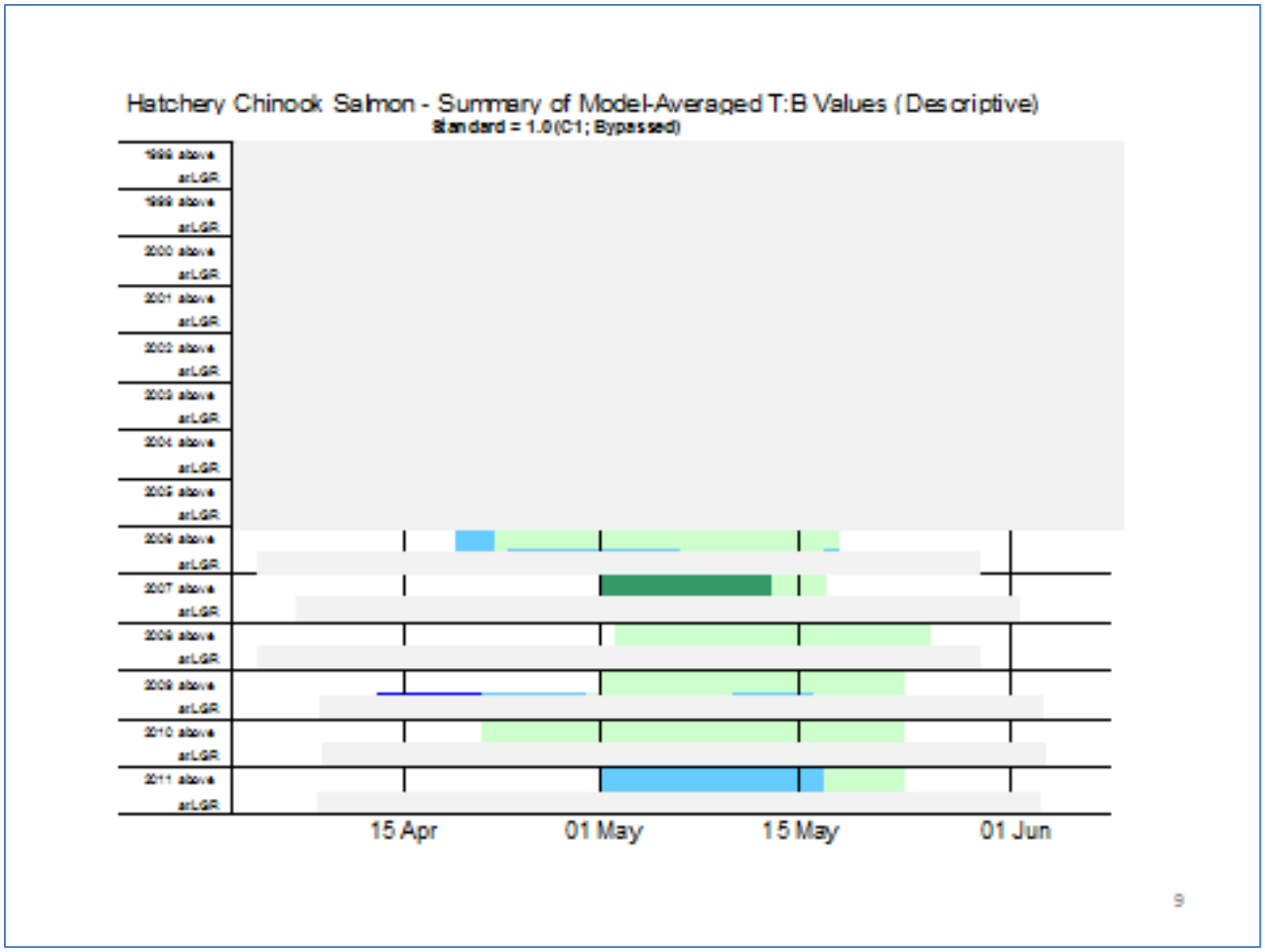
Slide 8a. This slide shows a basic change that has occurred that is evident for both steelhead and Chinook. Considering only fish released above LGR to avoid the bias previously described, there are few recent years with a significant transport benefit. The benefit of transporting fish, relative to bypassing fish, appears to be decreasing.



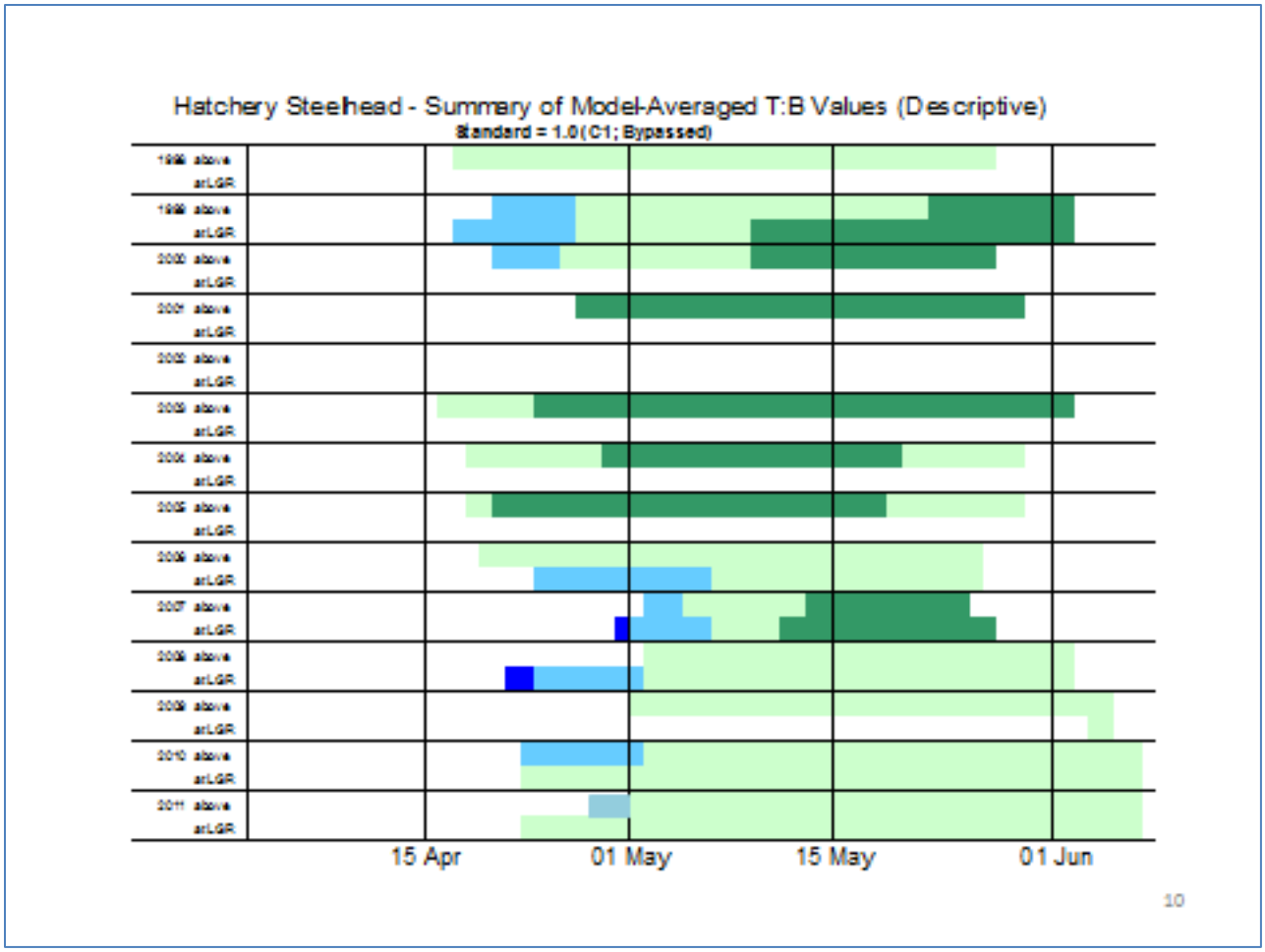
Slide 8b. If we filter out the years prior to 2006, and remove those data for fish marked at LGR to remove the at LGR marking bias, it appears there are no recent years with a significant transport benefit for wild Chinook based on NOAA's analysis. (As an aside, FPC altered the 2006 graphic to better represent the weekly SAR comparisons for illustration purposes). Based on these data it would appear that wild Chinook would not benefit from increased transport in April as NOAA suggested in the 2014 Supplemental BiOp.



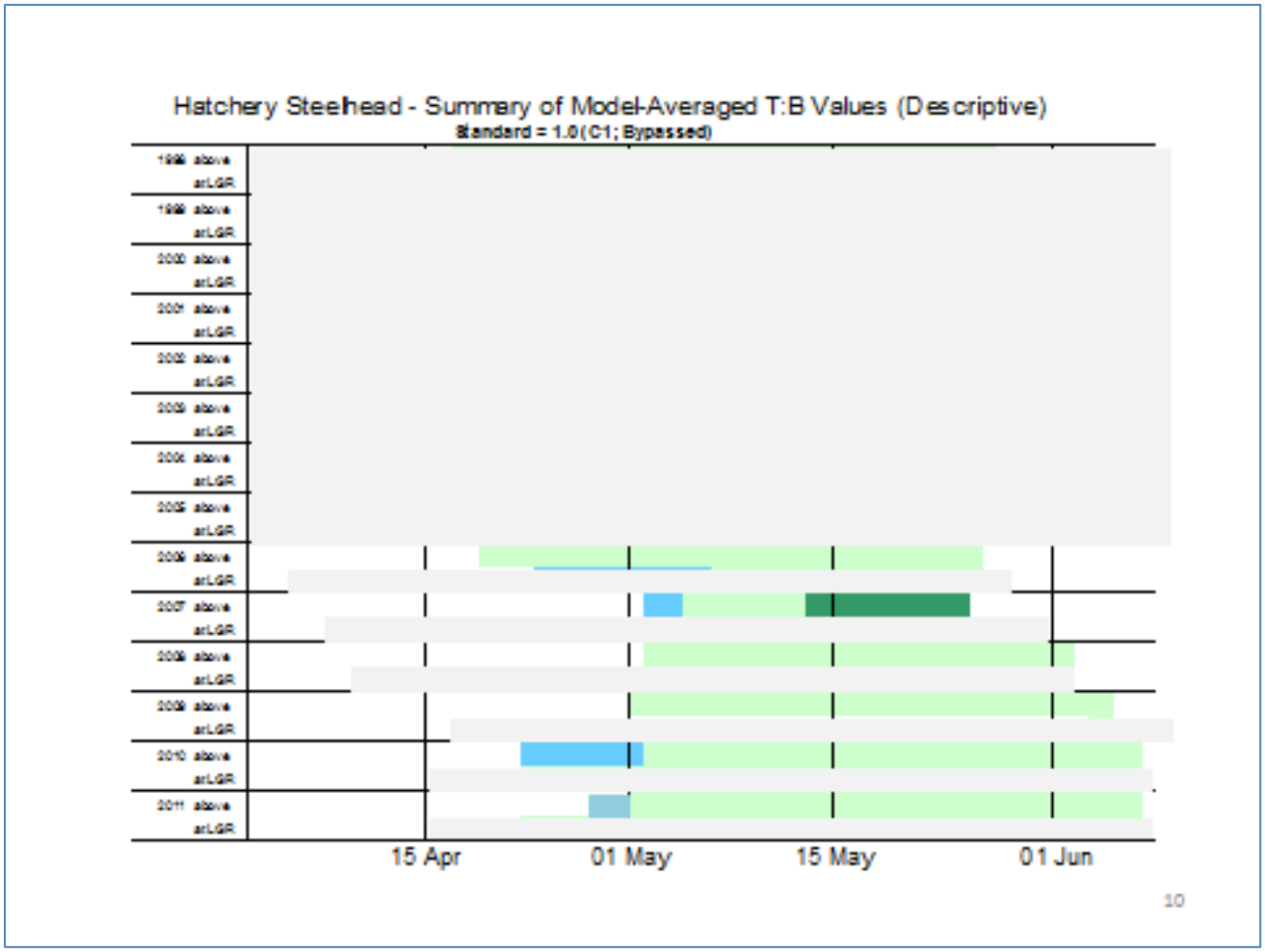
Slide 9a. Looking at the seasonal summary bar graph for Hatchery Chinook generated by NOAA, again the pattern of diminishing transport benefit relative to in-river fish is apparent.



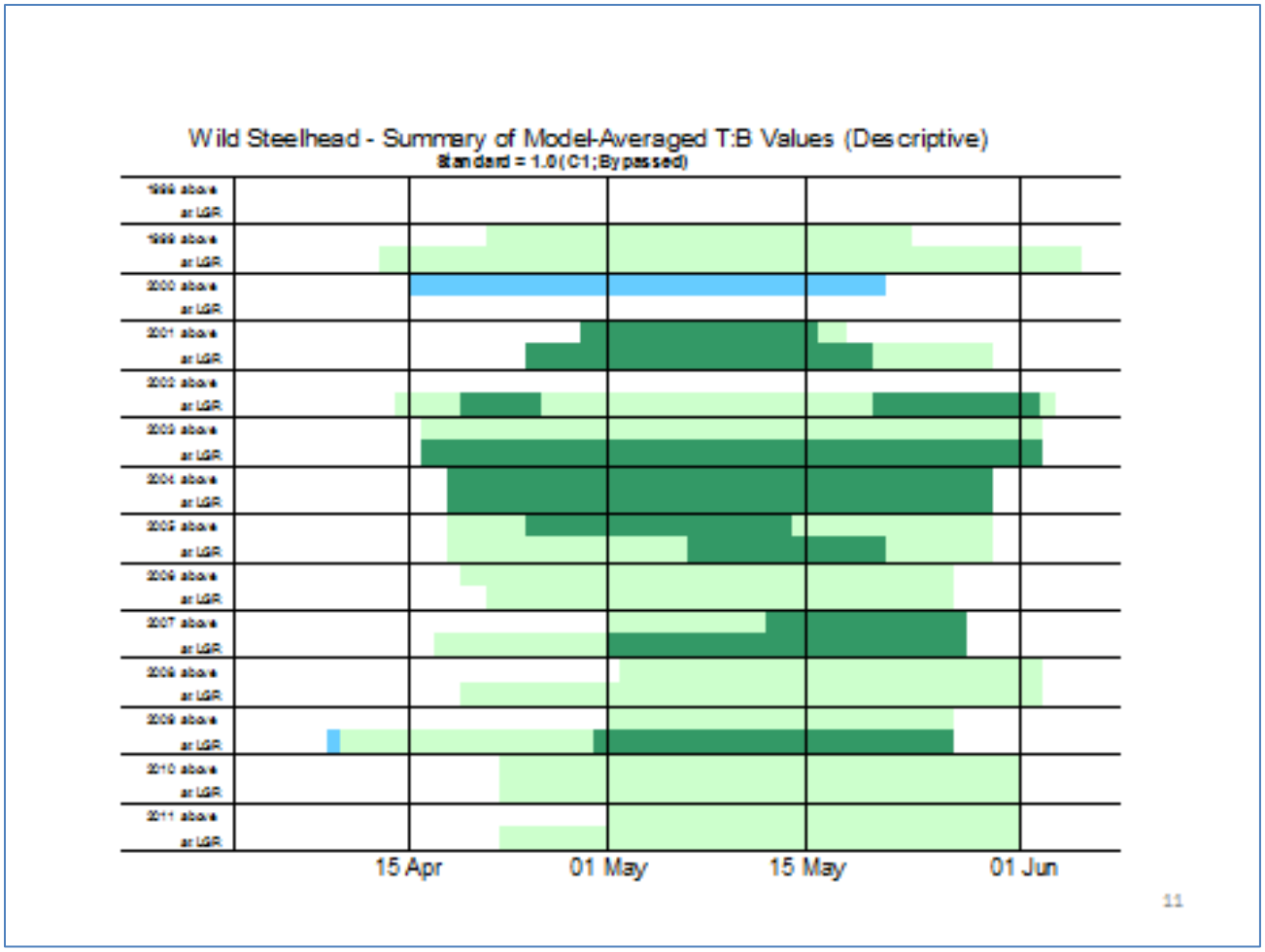
Slide 9b. If we filter out the years prior to 2006, and remove those data for fish marked at LGR to remove the at-LGR marking bias, there is one year in the past six with a significant transport benefit. And, that is for a short time period in May of 2007, a low flow year. Where data are available it looks like earlier April transport is not supported, especially given the data for 2011 showing an (non-significant) in-river benefit into mid-May.



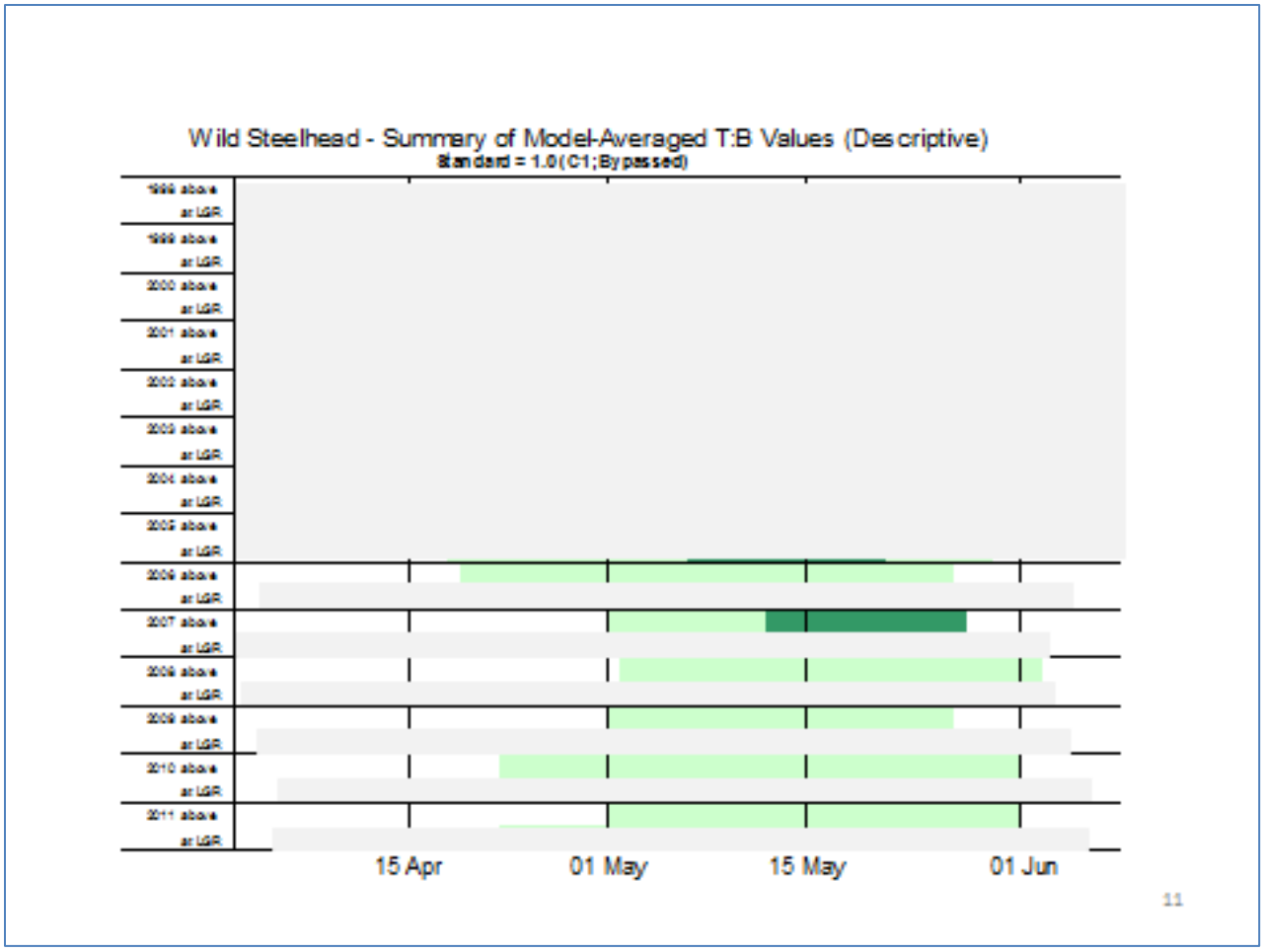
Slide 10a. Looking at the seasonal summary bar graph for Hatchery steelhead generated by NOAA, again the pattern of diminishing transport benefit relative to in-river fish is apparent (again, only a significant transport benefit in mid-May of 2007).



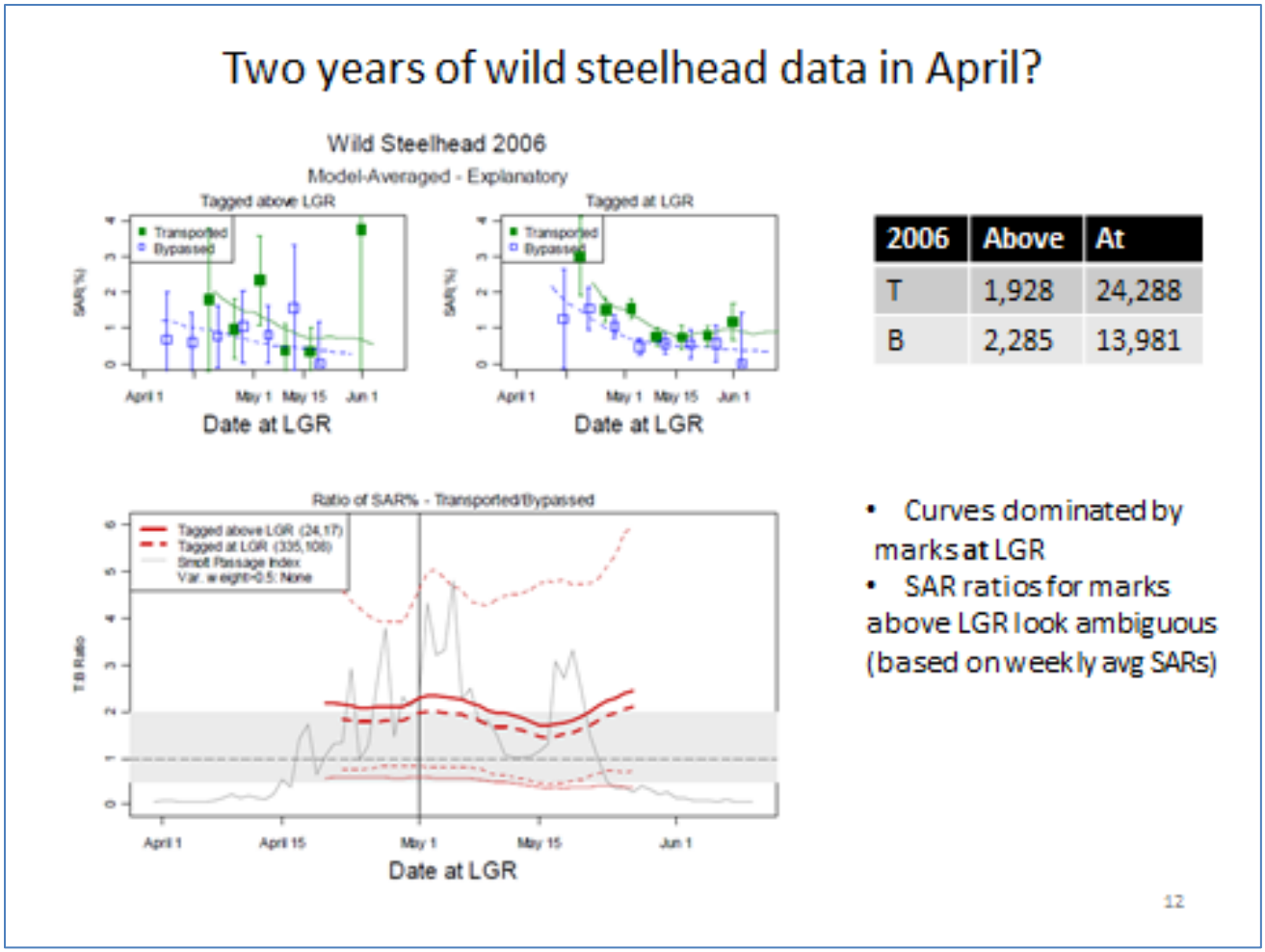
Slide 10b. If we filter out the years prior to 2006, and remove those data for fish marked at LGR to remove the at-LGR marking bias, there is one year in the past six with a significant transport benefit. And that is for a short time period in May of 2007, a low flow year. Where data is available it looks like earlier April transport is not supported especially given the data for 2010 showing an (non-significant) in-river benefit into early-May. (As an aside, FPC altered the 2011 graphic to better represent the weekly SAR comparisons for illustration purposes). And if we compare the April bypass SAR to the transport SAR there appears to be a no-significant benefit for hatchery steelhead to remain in-river based on the NOAA analysis of fish marked above LGR since 2006.



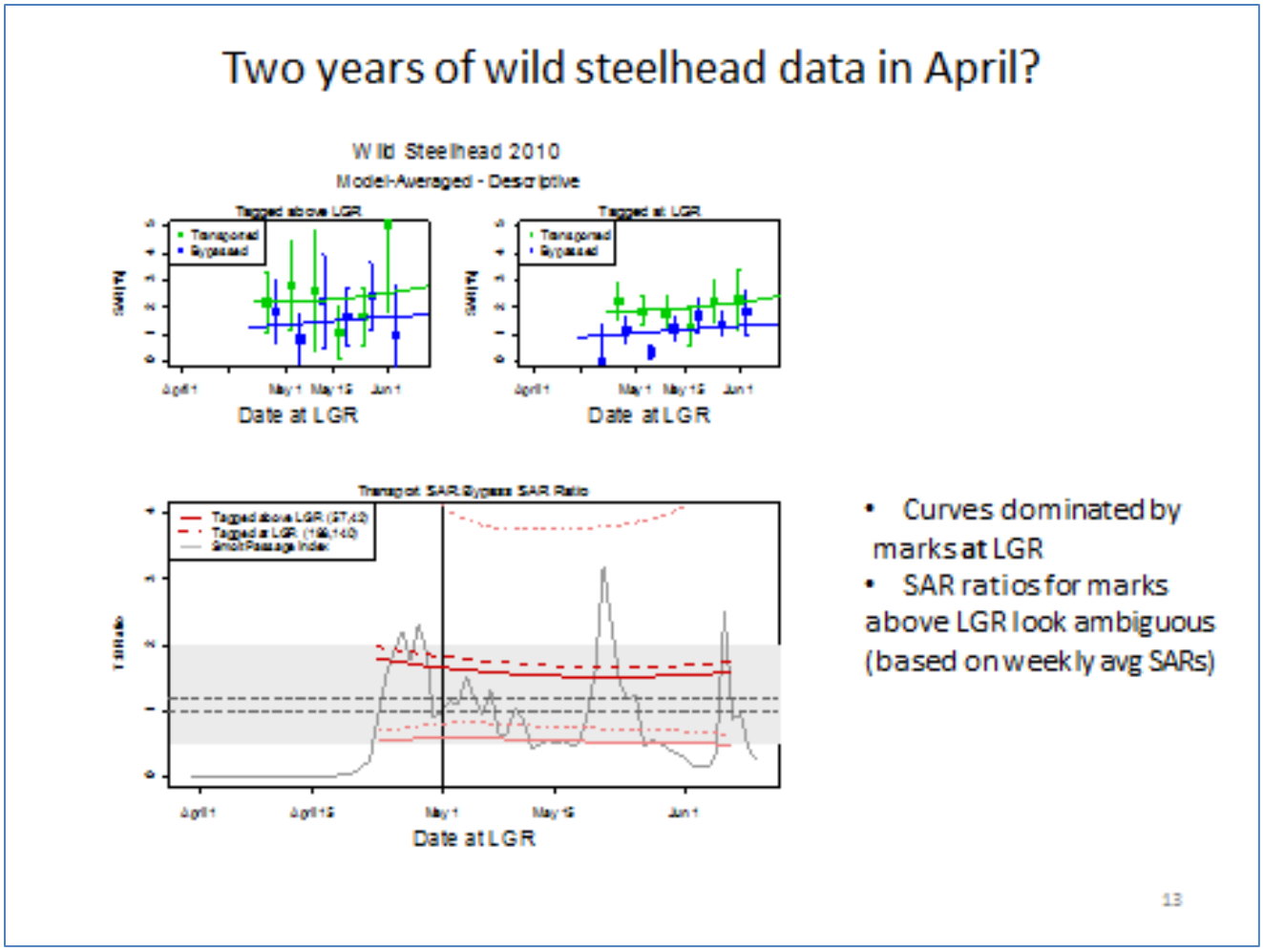
Slide 11a. Looking at the seasonal summary bar graph for wild steelhead generated by NOAA, again the pattern of diminishing transport benefit relative to in-river fish is apparent (again, only a significant transport benefit in mid-May of 2007 for fish marked above LGR).



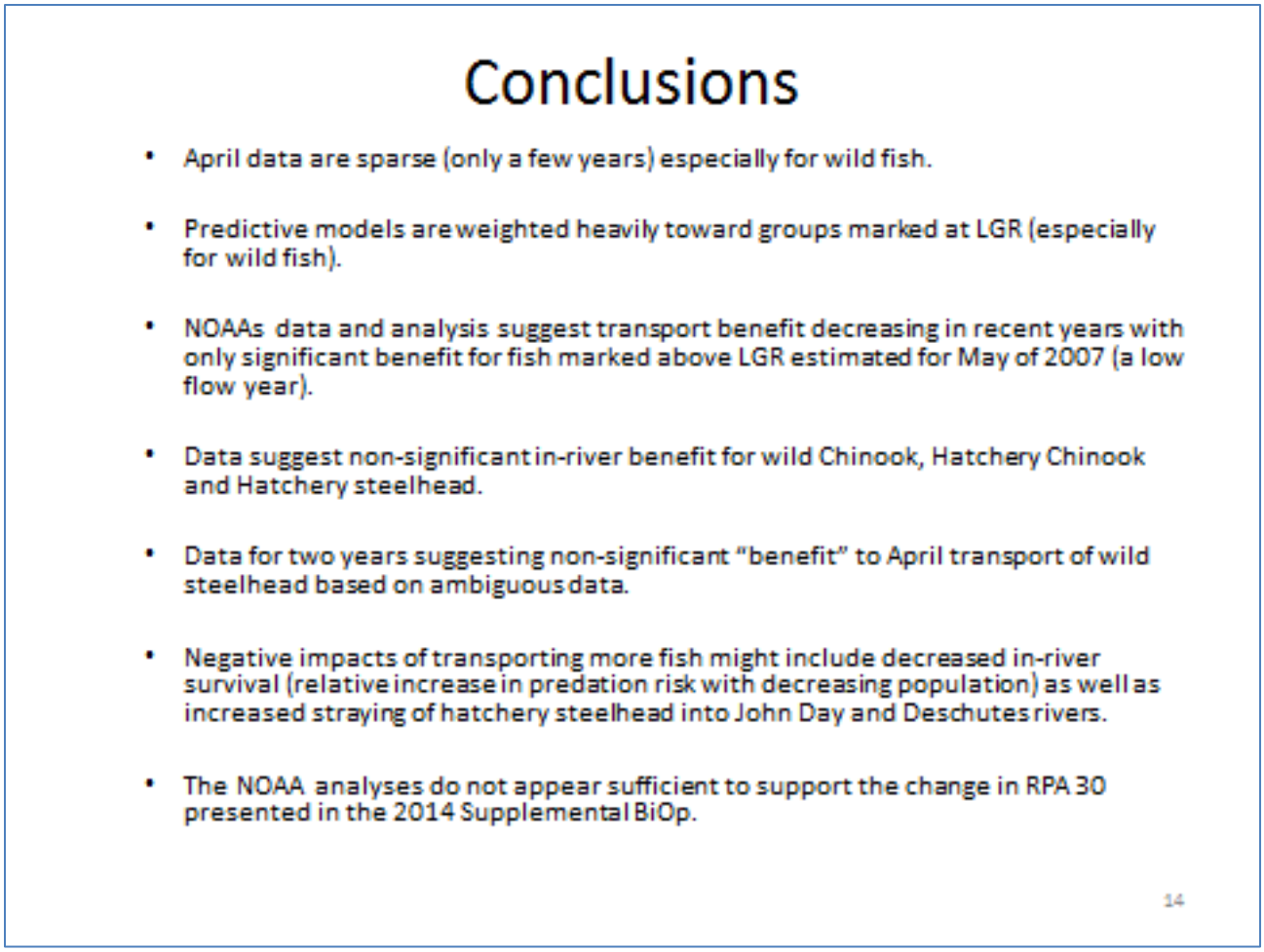
Slide 11b. If we filter out the years prior to 2006, and remove those data for fish marked at LGR to remove the at-LGR marking bias, there is one year in the past six with a significant transport benefit. Again that year was 2007. Based on the NOAA graph, there appears to be two years (2006 and 2010) when there was a (non-significant) benefit to transporting wild steelhead in April.



Slide 12. As stated previously, based on the wild steelhead marked above LGR, there were two years that appeared to indicate a non-significant benefit to transport relative to bypassed fish from the NOAA analysis. One of those years was 2006. However, when considering the data comparing weekly SARs of transport and bypassed fish, the predicted curves do not appear to fit the data very well. Indeed, comparing weeks in April it appears that in one week the transport SAR is higher and in the next, in late April, it is lower. Continuing the weekly comparisons into May the patterns of SARs appear to alternately appear opposite of, and then similar to, the predicted lines for the fish marked above LGR. Similar to the wild Chinook data in 2006 it appears that the simultaneously fitted curves fit best for fish marked at LGR but perform poorly for fish marked above LGR. That results in a curve depicting the predicted T:B ratios that does not represent the fish marked above LGR well. Looking at the data, it is apparent that over 38,000 fish marked fish at LGR were included in the Poisson regression, while only 4,000 fish marked above LGR were included. Nearly 10 times as many fish marked at LGR were included in the regression. Again the difference in weekly confidence intervals shows the relative precision/weight given to each group of fish.



Slide 13. The other year that showed a non-significant transport benefit relative to bypassed fish from the NOAA analysis was 2010. Looking at that data shows a similar lack of fit for the fish marked above LGR, and therefore lack of representativeness of the predictive curves for those fish. The confidience intervals for the fish marked at LGR indicate the relative precision/weight of those data versus the fish marked above LGR. Comparing individual pairs of transport/by-passed SARs, the late-April pair appears similar given the wide intervals. Pairs of SARs in mid- to late-May are not reflected by the differences in the predictive curves. Thus the curve of the ratios of SARs or T:B is not representative of the seasonal benefits to wild steelhead. Based on these data, it would appear that these two years don't represent strong evidence for changing the BiOp RPA 30 transport dates to an earlier date for wild steelhead.



Slide 14. Based on our review, we conclude that the data and analyses presented by NOAA do not provide a sufficient basis for changing RPA 30 as presented in the 2014 Supplemental BiOp. The data NOAA used to justify the change were sparse, as NOAA even acknowledged. The predictive curves used to depict the T:B ratios for wild fish marked above LGR were weighted toward the pattern of SARs of fish marked at LGR, and did not appear to adequately represent the actual T:B ratios of SARs for fish marked above LGR. NOAA's analyses showed a decreasing occurrence of periods when there was a significant benefit to transport for all groups hatchery and wild, Chinook and steelhead. Data suggest a non-significant benefit to bypassing all groups except wild steelhead. And, for wild steelhead the two years that showed a non-significant benefit to transport versus bypass, the data for fish marked above LGR was ambiguous and was not well represented by the predictive curves.

While there appeared to be little data to support the change to an earlier transport date, there are likely to be negative impacts to moving the transport date earlier. It would likely increase the number of hatchery steelhead strays to the Deschutes and John Day rivers. Also, as NOAA suggested in the 2013 analysis, there may be an impact to SARs of in-river fish, including those fish passed in spill, due to reductions to in-river populations and consequent increase in predation risk.

Literature Cited

NMFS (National Marine Fisheries Service). 2014. Endangered Species Act Section 7(a)(2) Supplemental Biological Opinion Consultation on Remand for Operation of the Federal Columbia River Power System. NMFS, Northwest Region, Portland, Oregon. January, 2014.

Smith, S., D. Marsh D., R. Emmett, W. Muir, and R. Zabel. 2013. A Study to Determine Seasonal Effects of Transporting Fish from the Snake River to Optimize a Transportation Strategy, NOAA Memorandum to USACE, MIPR Number W68SBV10698480.