State, Federal and Tribal Fishery Agencies Joint Technical Staff Letter

April 16, 2007

Mr. Mark Bagdovitz, Chairperson MAG
USFWS
911 NE 11th Ave.
Portland, OR 97232-4181

Dear Mr. Bagdovitz:

As requested by individual CBFWA members, the state, federal and tribal fishery managers have reviewed the report entitled, "**Pacific Ocean Shelf Tracking Project (POST): Results from the Acoustic Tracking Study on Survival of Columbia River Salmon, 2006**", and offer the following review comments for your consideration.

General Comments

This first year of research addressed the use of acoustic telemetry in estimating hydro-system survival and providing additional timing, and survival information into the marine environment. This feasibility study was useful to establish initial data on these acoustic tags in terms of longevity and detection rates at in-river and continental shelf arrays. However, data generated by this study in 2006 should only be considered useful in demonstrating the feasibility of using acoustic telemetry to measure fish passage in-river and along the continental shelf. The results of this feasibility study are not appropriate for developing broad conclusions about transportation benefits, delayed mortality, ocean survival, or ocean migration patterns of Columbia River migrants. The feasibility study has considerable limitations associated with mark groups, such as minimum size, different release and ocean entry timings, methods of marking each group separately, as well as lacking analysis of array detection probabilities in the ocean.

We are concerned that the authors have overlooked the limitations in their feasibility study and have extended their preliminary data on feasibility to address significant hypotheses. Specifically, the report states that telemetry data was used to test two hypotheses:

> *1. Is additional "latent" or "delayed" mortality experienced after Snake River smolts pass the eight dams they encounter as in-river migrants? If so, this would be evidence for the PATH hypothesis that cumulative stress from multiple dam passage is reducing the productivity of important Snake River chinook stocks.*
>
> *2. Does transporting/barging of chinook smolts improve early marine survival rates over run of river smolts? If so, then transporting smolts down-river should provide a boost to adult return rates, reducing extinction risk.*

We do not believe that the research results from a single year of feasibility investigation (2006) provides meaningful inference about these two hypotheses. There are several issues that need to be resolved with the techniques used in order to make inference to the broader population appropriate and to increase our confidence in the survival estimation methods. We are not confident that methods of calculating survival based on detections at the POST array, are accurate. It is possible that fish swam outside the array or that certain arrays were not operating as some fish passed that may bias results. More traditional methods of detection probability would be useful for comparison, such as mark-recapture methods.

Given our concerns, the following statement from the researchers is troubling;

> *"We do not find evidence that "delayed" or "latent" mortality has been expressed in the region that we conducted the 2006 pilot study—the upper reaches of the Columbia/Snake River system to the northern tip of Vancouver Island."*

The researchers base this conclusion upon comparisons of survival between Yakama River and Snake River groups in the lower Columbia River and early ocean. However, we do not agree that differences in survival between these two research groups can be applied to the larger populations. (See discussion below about limitation of study design). The above quoted statement implies that these results have broader scope than the techniques and sample size would justify.

The researchers also attempt to generalize from their results regarding transported fish to overall transported population;

> *"That is, the level of ocean mortality we are measuring is higher than the in-river mortality, so transport places the fish in a higher mortality environment for a longer time period."*

If the ocean mortality rate was as high as they measured, then it would be difficult for anadromous fish to persist. However, this differential in mortality rate could indicate that the tags used in this study may be causing much higher than natural mortality in the ocean. Definitive conclusions cannot be developed based on the information collected to date with this study.

The authors make the following statement "…*but the key principle is that the later in the life history that comparative survival can be measured, the better the assessment will be of the merits of transport for Snake River salmon stocks.*" We agree with this statement, and that is why we support the NMFS and CSS approach of using SARs to evaluating the benefits of transportation.

In conclusion, we are encouraged that the first year results of this feasibility study shows potential for this methodology to increase our understanding of the early ocean period of Columbia River anadromous fish. However, we want to stress that due to limitations in the study design that will be discussed in following sections of this memo, broad conclusions cannot be drawn from this one year of feasibility research. The present data should not be used to make inferences in migration timing or survival, or the benefit of the smolt transportation program. The conclusions made by the authors are not justified based on the results obtained to date.

Specific Comments on study design and methods

Size of marked fish

The marking of larger hatchery fish and the unique ways different marked groups were handled, limit inference to the broader hatchery population, let alone listed wild fish. Fish used in this study were minimum 140mm fork length at marking. This is very large compared to average size of even hatchery origin fish at the time of marking. At present, it is likely that the acoustic tags available do not allow the researchers to mark small fish, such that the marked population could represent the unmarked population. In this study, the authors should acknowledge the tag size limitation.

The authors also state that they saw no consistent patterns in survival estimates that would suggest that larger smolts have better survival within the Columbia River, but note there is some slight evidence for this at the northern end of Vancouver Island. From this the authors conclude that the size of the acoustic tag used with the POST array does not seem to have a significant influence on smolt survival over the size range tagged. Once again we believe it is premature to make such a definitive statement on the limited data collected to date. We also note that not only is there an indication of size selective mortality at Lippy Point, but also in the Snake River ROR 1 release group estimated survivals at each receiver array from Lake Wallula through Willapa Bay as shown in Figure 21(a). Hopefully, data collected in the next year or two will provide better insight into the affect of these acoustic tags on size selective mortality. We also hope the trend in tag size reductions continue so that a more representative size range of the population can be evaluated in the future.

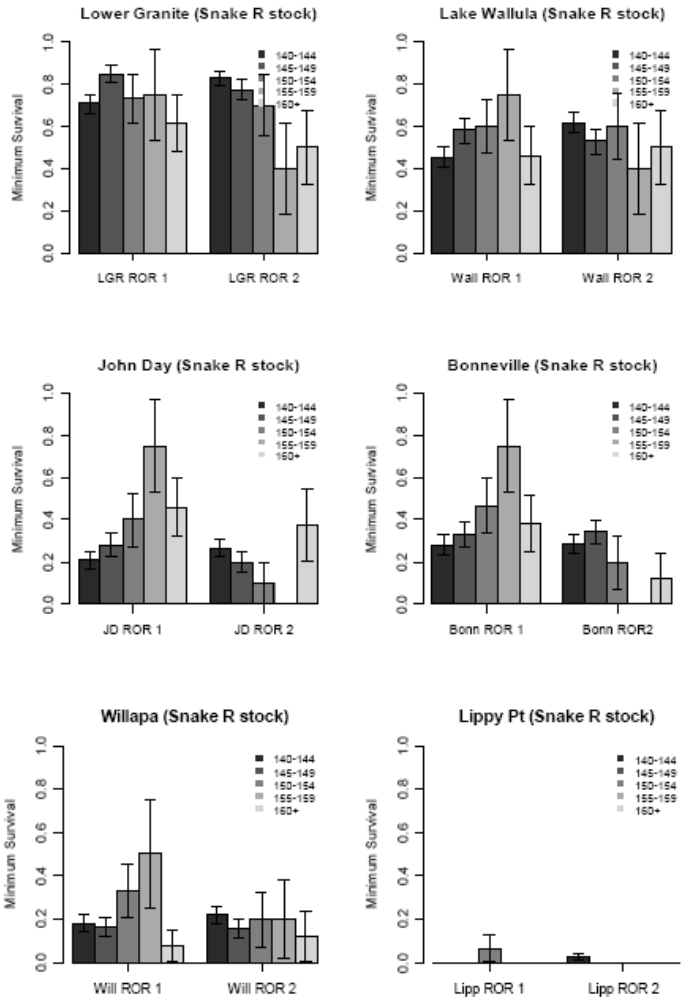

Figure 21(a). Comparison of raw survival estimates divided into 5 mm fork length intervals of ROR Snake R chinook smolts to each of the in-river and ocean listening lines.

Mark Group handling

Tagging effects cannot be controlled, given their study design so that comparisons between groups may include differential mortality for different tag groups. The Snake River ROR fish were marked and released a month prior to Snake River Transport releases so that it is impossible to assess potential confounding affects of different tagging operations.

Transport fish were marked and trucked to Lower Granite Dam and then loaded into barges. As a result, survival estimates for these fish may not represent transported fish that migrate from hatcheries, are collected at Lower Granite Dam and then transported. Also their time of release to the estuary is very late for hatchery fish. Using this type of a release group to ascertain information about "D" in actual transported fish is not justified.

The Yakima River smolts were volitionally released from acclimation ponds, recaptured at the Chandler Canal, tagged, and then allowed to continue their migration. In contrast, the

Dworshak fish were marked prior to release from the hatchery. This adds the confounding affect of natural mortality occurring before the Yakima smolts were tagged. Also, data from NMFS research at Lower Granite Dam shows that smolts marked after being collected at a dam have lower SARs than those tagged before release from a hatchery and then subsequently being collected at that same dam. We recommend in the future that handling of study fish be adjusted to mimic what happens to the population at large as much as possible to reduce these confounding affects and make the study more representative of actual conditions.

NMFS research has shown dramatic changes in SARs with different ocean entry timing. Because of this, these researchers chose to include the confounding effect of releasing the different study groups at different times so that they would hopefully arrive at the ocean at the same time and avoid the confounding affect of different ocean entry timing. The researchers unfortunately failed in this goal, with the earlier released Snake River ROR smolts entering the ocean ahead of the Yakima or transported smolts they were to be compared with, resulting in this study now having both confounding effects of different release and ocean entry timings.

Given the delayed mortality hypotheses the authors were trying to address, we also question why they attempted to experimentally time the ocean entry to be identical for the treatment groups. Although Dworshak and Yakima hatchery fish have similar outmigration timing leaving the tributaries, the hydrosystem alters estuary arrival timing for all three groups. The delayed estuary entry timing of in-river migrants is primarily an effect of the hydrosystem, and a likely mechanism for delayed mortality. We recommend in the future that that release timing be the same for each of the different groups so that the potential affects of the hydrosystem and the transportation program on ocean entry timing can be evaluated.

Survival Estimation

The use of the terms “minimum survival” and “survival” are misleading. What the authors call “minimum survival” is simply the number of detections at an array and “survival” is really an expansion of detections based on within array expansion techniques. A more robust survival estimation method requires some estimation of detection probability for each array. The overall array detection efficiency, for ocean arrays, was not directly estimated, instead the authors assumed, based on fish distribution across each array that detection efficiency was 95%. However, the distribution data, particularly for Snake River origin fish, does not justify such an assumption, since many are near the offshore end of the arrays. In fact several detections are from the very last node at the offshore end of the Willapa Bay array, indicating that some of the Snake River fish may have gone undetected by passing the end of the array.

Reported results estimate that transported smolts survived to Lippy Point at about five times the Snake River ROR smolts (Table 3), yet PIT tag SARs consistently show a much lower T/C ratio with the Sandford & Smith or CSS methodology. This indicates that either these arrays do not encompass the area of latent mortality, or the above mentioned concerns with the methodologies caused the results to be erroneous.

Estimated survival to Lippy Point for the Yakima River smolts is lower than reported SARs from the Yakima River, and they still have several more years of mortality in the ocean. This indicates that true survival of Yakima River smolts is much higher than estimated here. Possible reasons for this low estimate are; the smolts marked were not representative of the population, some smolts migrated beyond the end of the arrays, some smolts rear for a time in

the estuary or along the continental shelf, the tags caused higher than natural mortality in the ocean, or a combination of these factors.

The authors report estimated survivals based upon very few detections (2 versus 4) as if they were absolutes; "survival of the Snake River population to Libby Point was double that of the Yakima population". The number of detections at Libby Point was too few to provide any confidence in estimates, and given the early arrival timing of Snake ROR fish such estimates could be biased low. The array became operational as the first detections occurred. Further, estimates of survival derived by within array estimates are not true survival estimates. The researchers provide no means for estimating true detection probability at this site.

Conclusions

In conclusion, we reiterate, this feasibility study was useful to establish initial data on the performance of acoustic tags, in terms of longevity and detection rates at in-river and continental shelf arrays. However, data generated by this study in 2006 should only be considered useful in developing acoustic telemetry methods with regards to measure fish passage in-river and along the continental shelf. The size of marked fish and the handling of mark groups, determine whether or not the marked study fish are representative. Tagged fish should be the size of the unmarked population, or researchers must recognize the potential bias and constraints upon research results. Also, tagged fish should migrate at the same time and in the same way as unmarked fish to be useful in making study results applicable to the population. Finally, survival estimation should use standard mark-recapture methods unless assumptions of those models cannot be met. Some means of determining whether fish move further off-shore in the near-ocean, beyond the extent of the POST arrays, or delay migration between arrays, would be helpful in determining the feasibility of those arrays for estimating survival.

Sincerely,

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Cc: MAG
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