PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

WORKING DRAFT

Science Policy Brief

Depositional Potential and Flow-Response Dynamics of Emergent Sandbars in a Braided River (Alexander et al. 2020)

Potential Implications for the PRRIP Adaptive Management Plan (AMP) and Governance Committee (GC) Decision-Making

By: Office of the Executive Director (EDO)
Date: 05/21/2020

The EDO developed this Working Draft brief for the PRRIP Technical Advisory Committee (TAC). It has not been peer reviewed and is not intended for external use or publication. This brief is intended to be used internally by the Program to consider the potential implications of new learning on key components of the Adaptive Management Plan (AMP) and to inform prior or future decision-making.

Background

In 2017 the Platte River Recovery Implementation Program (Program) published an analysis of least tern and piping plover reproductive ecology in relation to Platte River hydrology and sandbar dynamics (Farnsworth et al. 2017). That publication focused on an emergent sandbar habitat model developed by the Executive Director's Office (hereafter "Program model"). Program decision-makers (the Governance Committee, hereafter "GC") used the model as one line of evidence in assessing the Program's ability to create and maintain suitable on-channel nesting habitat via the Flow-Sediment-Mechanical (FSM) management strategy and the Short-Duration High Flow (SDHF) management action through a Structured Decision Making (SDM) process completed in 2016 (Compass 2016).

The Program central Platte River (CPR) model predicted a low overall probability of on-channel interior least tern and piping plover reproductive success in the Program's Associated Habitat Reach (AHR) and indicated that short-duration high flow (SDHF) releases would not create suitably-high sandbars for species nesting. The Program lower Platte River (LPR) model predicted a higher potential for species success in that reach. However, model estimates of piping plover success were not high enough to maintain a stable subpopulation.[1] Model estimates of least tern success indicated that ability to maintain a stable subpopulation were dependent on the success of late renesting following flood events. As mentioned above, Program decision-makers considered the Program models in their assessment of FSM, ultimately concluding that implementation of the FSM management strategy in the AHR would not create or maintain the on-channel habitat conditions necessary to achieve species management objectives.

Alexander et al. (2020; hereafter "Alexander") focuses on LPR sandbar dynamics, including development of a sandbar height regression relationship that differs from the one used in the Program model. The Program model assumed sandbars build to a constant height below peak stage. In the Alexander relationship, sandbar height varies in relation to peak discharge magnitude.[2] Alexander cites the Program publication and states that the sandbar height relationship presented in their manuscript is an improvement over the relationship used by the Program. Alexander also cautions against using the Program relationship to assess potential for on-channel nest inundation.

Program analysis of four peak flow events in the CPR did not identify an increase in depositional gap with increasing discharge (Farnsworth 2018) and the Alexander LPR regression relationship cannot be directly used in the CPR model due to differences in sediment grain size and transport mode. However, it is possible that analysis of additional CPR events could identify a relationship similar to what Alexander observed in the LPR. Should this be the case and application of the Alexander regression in the LPR model substantially increases probability of reproductive success in that reach, it may signal that the Program CPR model likewise underestimates the potential for success.

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[1] The analysis included the contemporary lower Platte because early Program documents hypothesized that on-channel tern and plover productivity on the lower Platte is sufficient to maintain stable species subpopulations, the contemporary lower Platte is an analog of the historical central Platte and implementation of SDHF would create conditions similar to those in the lower Platte.
[2] The EDO Alexander relationship predicts higher sandbars at formative discharges below 35,000 cfs and lower sandbars at formative discharges above 35,000 cfs.

Modeling

We modified the LPR segment of the Program emergent sandbar habitat model to use the Alexander sandbar height relationship. Application of the Alexander relationship predicted decreased sandbar height for 80% of model habitat-forming discharges (observed peak flows 1954-2017), consequently reducing the modeled potential for reproductive success in that segment. Median piping plover success window[3] declined from 11 days to 0 days and median least tern success window declined from 27 days to 10 days.

Program model performance was originally assessed by comparing observed instances of nest inundation events to model predictions (Farnsworth et al. 2018). The original LPR model (Program relationship) slightly underpredicted inundation in that it did not predict sandbar inundation in some instances where sandbar inundation and nest loss were observed. When modified to use the Alexander relationship, the Program model overpredicted inundation. For example, observations of LPR bars indicated that they were inundated until mid-June in both 2016 and 2017. The modified model predicted bars to be inundated until July 1 in 2016 and July 28 in 2017.

Potential Policy Implications

As mentioned above, we have not observed an increase in depositional gap with increasing discharge in the CPR. However, we can infer the consequences of replacing the CPR bar height constant with a variable regression where the depositional gap increases with increasing discharge. In the CPR reach, our observational studies and modeling indicate peak discharge magnitudes exceeding a 10-year return period (13,000 – 15,000 cfs) are necessary to produce emergent sandbars that meet the Program's minimum height suitability criterion. In the LPR model segment, the Alexander regression predicts lower bar heights for peak discharge magnitudes exceeding about a 2-year return period (35,000 cfs). Replacing the CPR sandbar height constant with a variable regression relationship that reduces sandbar height for infrequent high-magnitude peak flow events would further reduce the potential for reproductive success in the CPR reach because those are the only events that create suitably-high bars. Consequently, we conclude that use of an Alexander-like variable discharge gap in the CPR would not change the Program's assessment that SDHF (5,000 – 8,000 cfs for three days at Overton, NE) will not create suitable least tern and piping plover habitat. This supports the GC's decision to focus on creation and maintenance of off-channel nesting habitat as an alternative to SDHF-created on-channel habitat.

References Cited

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Compass Resource Management. (2016). Structured Decision Making for Interior Least Tern and Piping Plover Habitat on the Platte River. Final Report Prepared for the Governance Committee, Platte River Recovery Implementation Program. 72 pp. https://platteriverprogram.org/document/final-2016-prrip-tern-and-plover-sdm-report-0

[3] Number of days during season when nests could be initiated and make it to fledging age without being inundated.

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