**PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM (PRRIP -or- Program)**

**PRRIP Extension Science Plan Target Species Summary: Interior Least Tern (LT) & Piping Plover (PP)**

January 2021

**Editorial Disclaimer:** This document serves as a PRRIP Executive Director’s Office (EDO) Working Draft summary of recent discussions with the Adaptive Management Working Group (AMWG) regarding the status of the LT and the PP within the Program as target species and science learning priorities for the PP (the LT was de-listed in January 2021) in development of the Extension Science Plan. AMWG meetings were held in accordance with direction from the Governance Committee (GC) as described below. This summary serves as a brief roll-up of extensive AMWG commentary over the course of several virtual meetings in the last half of 2020 and early in 2021. Some or all of the text below (as-is or as subsequently revised) may be integrated into the Extension Science Plan.

**AMWG Role in Development of PRRIP Extension Science Plan**

The GC re-constituted the AMWG in September 2020 and directed the group to be responsible for working collaboratively with the EDO to generate the technical content of the Extension Science Plan. Specifically, the AMWG was directed to work with the EDO to:

Science Plan content tasks:

1. *Evaluate and refine conceptual models* – ensure proper linkages between current Program understanding of river form and function and target species responses; identify areas and relationships with uncertainty needing further investigation.
2. *Identify important technical uncertainties and develop potential priority hypotheses* – based on areas of uncertainty in the conceptual models, brainstorm the language of hypotheses (determining *a priori* independent and dependent variables) for testing management actions, develop expected response functions (X-Y graphs for predicting response), and map out how answering hypotheses (and alternative hypotheses) will be communicated to the GC as an input to decision-making.
3. *Develop a new set of Big Questions for the Extension* – work collaboratively with the EDO to develop a proposed set of Big Questions for the Extension that serve as a roll-up of underlying hypotheses and that provide an organizational tool for tracking progress against management objectives and communicating science learning to the GC.

Science Plan process and communication tasks:

1. *Communicate technical information to the Technical Advisory Committee (TAC) and GC* – take ownership of content in the Extension Science Plan and present material at TAC and GC meetings.
2. *Participate in writing and technical review of the Extension Science Plan* – homework assignments, participation in numerous virtual and in-person (when allowable) meetings and workshops, and communication with the Independent Scientific Advisory Committee (ISAC).

The work of the AMWG was not intended to replace the review, recommendation, and approval authorities the Program Document delegates to the TAC and GC. Specifically, AMWG work products will be provided to the TAC for review and comment and the TAC will be responsible for recommending a final draft Science Plan for final GC review and approval. The frequency of AMWG interaction with the TAC will depend on Science Plan development progress but we anticipate regular check-ins to confirm that the larger body is comfortable with work products prior to advancing to each subsequent step of Science Plan development (see list above).

In developing the Extension Document, the GC decided that the current management objectives in the Adaptive Management Plan (AMP) should remain. As stated in the AMP, “management objectives are a means to evaluate effectiveness of different Program actions within an adaptive management framework.” Thus, management objectives are the currency with which the EDO and technical representatives of Program partners can communicate science learning and the effectiveness of management actions to the GC. The AMP does not prescribe a particular process for how this communication is to occur (i.e., who determines if the Program is meeting the management objectives and what does it mean to “meet” the objectives). The EDO intends to work with the AMWG going forward to iteratively evaluate whether the Program is currently meeting the management objectives, how those objectives are measured, and what it means for Program science learning as an input to GC decision-making. That evaluation will be transmitted to and discussed with the TAC and ISAC before being reported to and discussed with the GC via the annual *State of the Platte Report*.

**TARGET SPECIES MANAGEMENT OBJECTIVE: LT/PP**

The current LT/PP management objective in the AMP is:

Improve production of Least Tern and Piping Plover from the central Platte River.

1. Increase number of fledged tern and plover chicks.

i) Increase nesting pairs (indicator is nesting pairs).

ii) Increase fledge ratios (indicator is chicks successfully produced per unit adult, nest, or pair) and reduce chick mortality from causes such as flooding, predation, weather, inadequate forage.

1. Reduce adult mortality.

i) Reduce predation (indicator is nesting pairs).

**It is the consensus opinion of the AMWG that as of January 2021 the PRRIP is meeting the LT/PP management objective.** That consensus opinion is based on the following proxies:

* An increase in the number of LT & PP since the start of the Program in 2007.
* An increase in the amount of available nesting habitat for LT & PP since the start of the Program in 2007 that resulted in an increased number of birds.

Moving forward, the AMWG recommends using a suite of performance indicators to better assess and report on the Program’s progress toward meeting the LT/PP management objective. A downward trend in multiple indicators, for example, would likely raise a more substantive and concerning red flag than a single, possibly misleading indicator. The AMWG recommends the following suite of performance indicators:

* *Breeding pairs* – An estimate of the number of unique male/female pairs nesting at a specified location during a specified period of time based upon nest and brood counts and taking renesting into account [(Baasch *et al*. 2015)](https://onlinelibrary.wiley.com/doi/10.1002/ece3.1680). The Program typically reports breeding pairs at their peak, when numbers of breeding pairs observed during a single observation period within the entire Program AHR first peaked.
* *Eggs produced* – Highest number of eggs observed over the nesting period within a single unique nest. With current outside monitoring protocols, this performance indicator has not been measured, but under current and future nest camera monitoring protocols, this indicator can be obtained.
* *Egg survival* – Probability of an egg surviving daily (daily survival) or to hatch (incubation survival). With current outside monitoring protocols, this performance indicator has not been measured, but under current and future nest camera monitoring protocols, this indicator can be obtained.
* *Fledges* – Number of plover chicks attributed to a unique nest that survive to 28 days of age.
* *Fledge ratio (fledges/breeding pair)* – Number of fledges produced divided by the estimated number of breeding pairs calculated annually over the entire AHR or for each nesting site.
* *Adult survival* – Annual probability of a uniquely marked individual adult surviving and being detected from one year to the next. Estimates of adult survival require continuous banding and resighting of birds, therefore this performance indicator is not currently being measured by Program monitoring efforts.

These new/additional performance indicators could be used to assess the LT/PP management objective as follows:

1. Increase the number of fledged tern and plover chicks by:
   1. Increasing nesting pairs (indicator is breeding pairs); this would be accomplished through habitat creation.
   2. Decrease losses to predation (indicator is daily nest and brood survival, nests and broods fated as Failed Predated); this would be accomplished through predator management or potentially continuing to add additional acres of habitat. The GC agreed to add an additional 60 acres of nesting habitat during the Extension.
   3. Increase fledge ratio (indicator is fledges successfully produced per nest or breeding pair).
2. Reduce adult mortality
   1. Decrease losses to predation (indicator is adult mortality attributed to predation).

In terms of communicating continued progress toward meeting the LT/PP management objective during the Extension and beyond, the AMWG is interested in exploring the possibility of using the tool of risk analysis (Consequence (C) ratings, Likelihood (L) ratings, Risk (CxL) ratings, color-coded risk matrices) to identify performance indicator red flags. These would be longitudinal red flags, meaning over some longer time increment rather than concern about intra-annual changes in productivity metrics. For example: to communicate with the AMWG and the TAC, we could agree to numerical ranges that make sense based on Program learning, historical and recent literature, guidance from other programs, and guidance from the Service as to what is important re: the Biological Opinion. To communicate with the GC, we could just report risk ratings (based upon consequences to the target species and likelihood of failure to meet the management objective) and say if a performance indicator falls into a **green range**, nothing to see here; if an **orange range**, we are good but keeping an eye on things; or if a **red range**, the TAC recommends research or changes to management actions. The EDO, in consultation with the AMWG, the TAC, and the ISAC, would still assess annually in the *State of the Platte Report* whether the Program is meeting the management objective but that would be weighed against expected changes over time.

**TARGET SPECIES UNCERTAINTY: PP**

Since the LT was de-listed in January 2021 it appears the PP will be the focal target species for the Program during the Extension. The AMWG focused discussion on remaining areas of uncertainty related to PP productivity over time.

**Big Questions = things we do not know but want to learn**

1. **Why did PP productivity numbers decline from 2017-2019?**

Based on the results of annual Program monitoring, PP productivity declined over the three-year period from 2017-2019. Although productivity numbers increased during the 2020 nesting season, Program participants still expressed concern over the previous decrease. The Program is not certain of the cause for this episodic productivity decrease, leading to the exploration of predation as one possible cause. As noted by AMWG members, breeding bird literature indicates weather patterns, forage availability, habitat structure, and other factors can be important.

*Uncertainty Factor = Predation*

The AMWG identified the impacts of predation on plover productivity and the Program’s ability to mitigate this impact as an area of remaining uncertainty for which negative impacts on productivity have been documented and the Program has the ability to manage. The AMWG discussed options for addressing this uncertainty and agreed the best approach would be through the implementation of management practices in a systematic way that allows the Program to quantify the impacts of predation on productivity and the Program’s ability to mitigate those impacts.

Relative to predation, a question of interest: What is the impact of predation on PP productivity and how can the Program reduce the impact of predation on PP productivity?

*Uncertainty Factor = Forage*

The AMWG engaged in a discussion about PP forage availability (invertebrates along wetted habitat perimeters, both on- and off-channel) as another possible factor in the recent PP productivity decrease. Little is known about the type and abundance of invertebrate forage available to PP on the central Platte each summer, though there is concurrently little data suggesting that PP fitness is in decline or can be attributed to summer forage availability on the central Platte. But this may be an area of interest for Program-supported or independent research.

Relative to forage, a question of interest: Are there enough forage resources on off-channel habitat PP nesting sites to maintain PP productivity, what influences forage resource availability on off-channel sites, and how can the Program implement management actions to improve forage availability?

**REVISING THE EXTENSION SCIENCE PLAN**

At this time, the AMWG does not foresee establishing additional new Big Questions or specific priority hypotheses related to the PP for the Extension to be addressed through a rigorous application of the adaptive management (AM) six-step cycle. There may be additional areas of uncertainty related to PP productivity identified during continued development of the Extension Science Plan in 2021 or during subsequent implementation of the Science Plan that might require review and development of an AM approach to address related uncertainty. For now, the AMWG recommends the Program focus on annual monitoring and watching the ranges of performance indicators to keep track of how the Program is performing against the management objective.

**REFERENCES CITED**

Baasch DM, Hefley TJ, Cahis SD. 2015. A comparison of breeding population estimators using nest and

brood monitoring data. *Ecology and Evolution* 5(18): 4197-4209. <https://onlinelibrary.wiley.com/doi/10.1002/ece3.1680>