Quantity, Quality, Timing and Distribution of Flow along the Transition Zone of Shark River Slough, Everglades National Park, FL

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INTRODUCTION

Improving the quantity, quality, timing, and distribution (QQTD) of freshwater flows through Everglades National Park (ENP) is a primary goal of the Comprehensive Everglades Restoration Plan (CERP). The U.S. Geological Survey (USGS), in cooperation with the Greater Everglades Priority Ecosystem Science Program (GEPES) and the CERP RECOVER Monitoring Assessment Program, operates a coastal network of hydrologic stations to quantify the volume of freshwater delivered to the mouths of coastal rivers and to the transition zone between the freshwater wetlands and the headwaters of tidal creeks. Flows represent pre-restoration hydrologic conditions useful for comparing with post restoration conditions. The data can be used to create simple models for predicting flows within the transition zone.

From 2003 to 2011, flow in the Shark River Slough transition zone was monitored at Upstream North River (UNR), Bottle Creek near Rookery Branch (BC), and Upstream Broad River (UBR), and flow was monitored in Lostmans Slough at Upstream Lostmans River (ULR) (Fig. 1). Water levels were monitored at EDEN 3, located slightly upstream of UBR, from 2005 to 2011. The quantity and distribution of flow at the upstream transition stations is shown in figure 2.

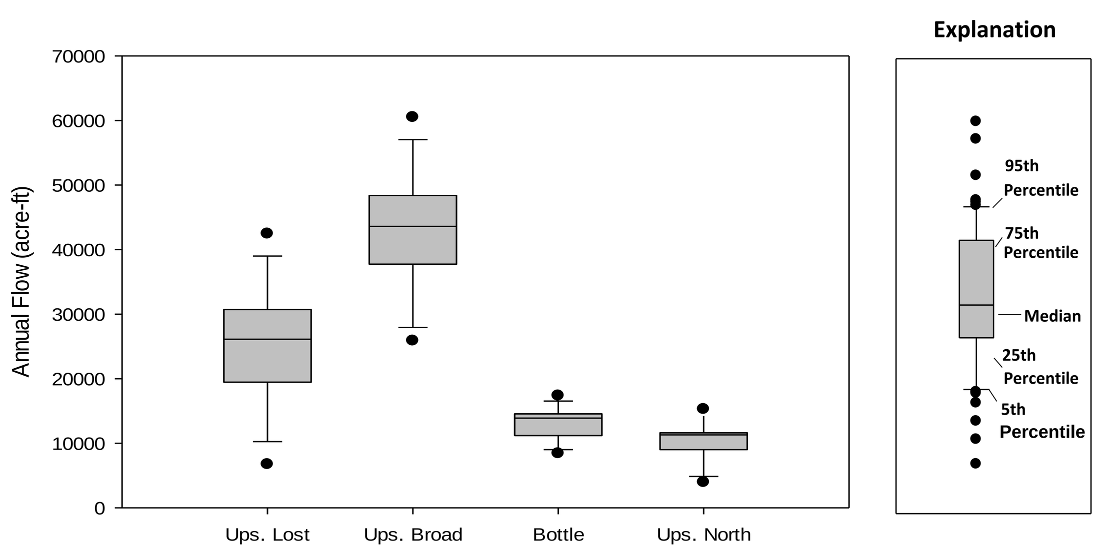

Figure 2. The quantity and distribution of flow at USGS stations in the Shark and Lostmans Slough transition zone, 2004 to 2011.

OBJECTIVES

1. Develop regression models from mean monthly water levels at the EDEN 3 station and mean monthly flows at select USGS transition zone stations (Fig. 3A-D).
2. Develop regression models from mean monthly water levels at select NPS surface water stations and mean monthly flows at select transition zone stations (Fig. 4A-D).
3. Use the models to compute mean monthly flows for extended time periods.

METHODS

1. Continuous discharge record at ULR, UBR, BC, and UNR were computed using the index velocity method (Levesque and others, 2012).
2. Because ULR, UBR, and UNR are tidally affected, the computed discharges were filtered using the Godin low pass filter to produce mean discharges (USGS SW10.08).
3. Mean monthly data for analysis was acquired from the USGS National Water Information System (http://waterdata.usgs.gov/nwis) and the National Park Service.

STUDY AREA

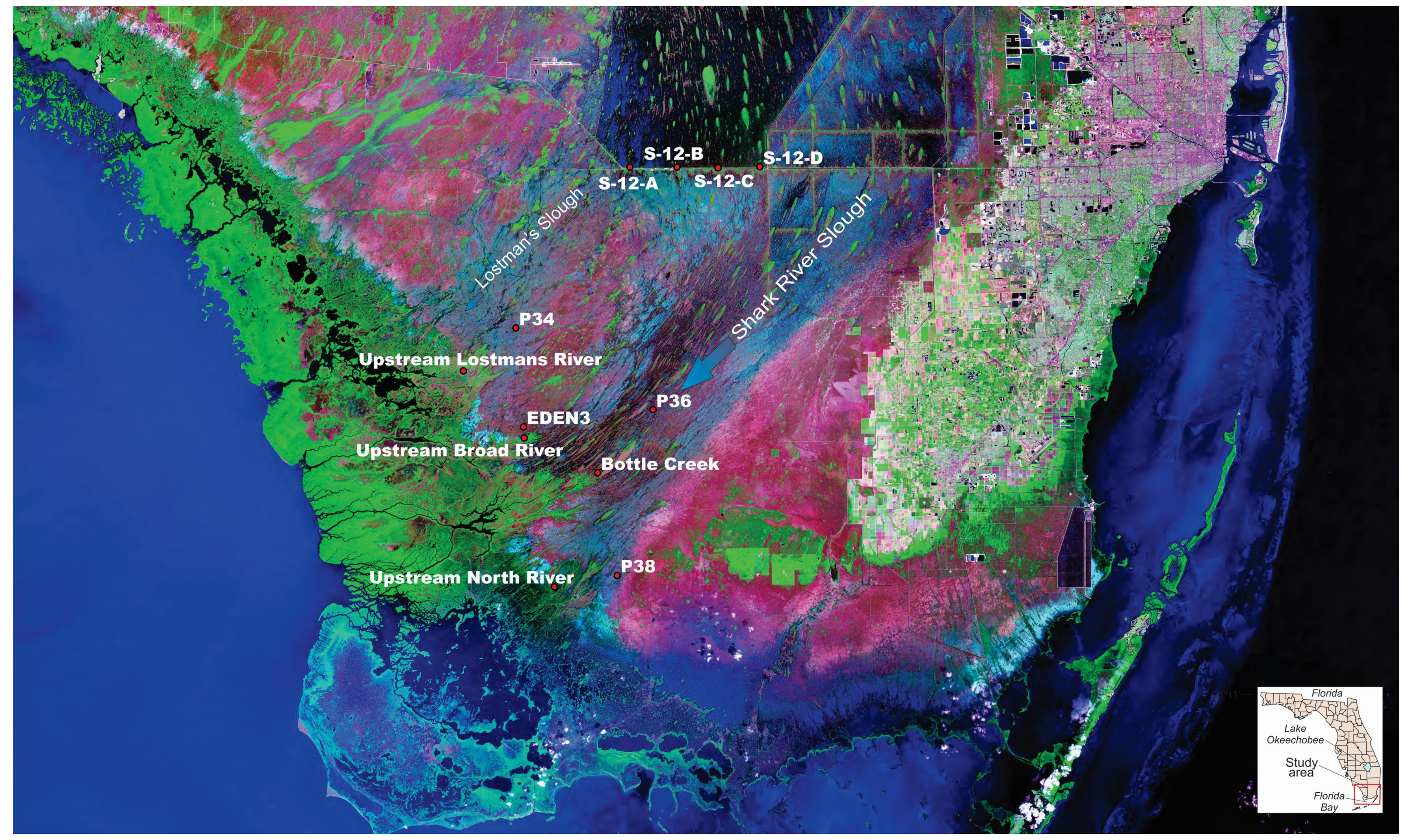

Figure 1. The study area in Lostmans and Shark River Slough, Everglades National Park, FL

RESULTS

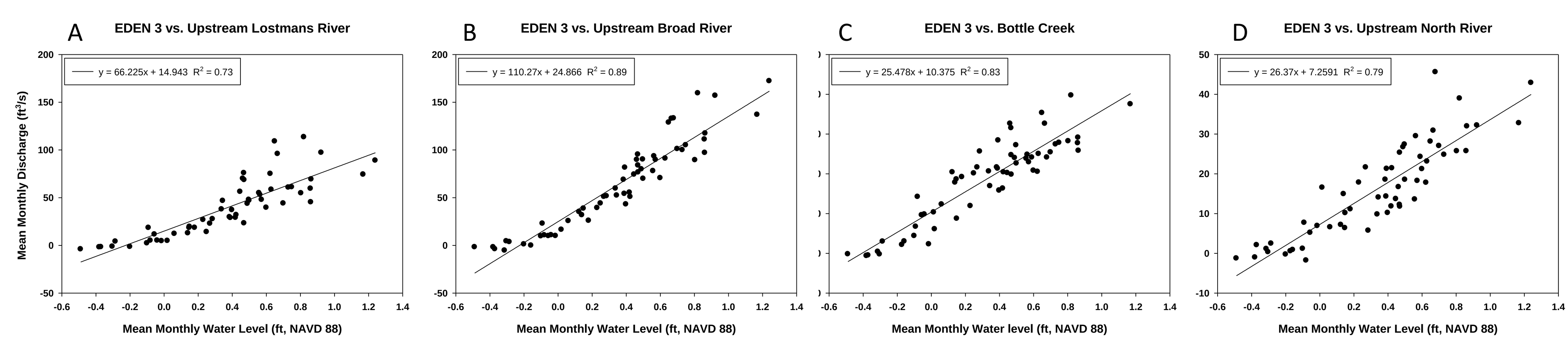

Figure 3. The above graphs represent the relations developed between mean monthly water level (ft, NAVD 88) at the USGS monitoring station EDEN 3 and the monthly mean discharge (ft^3/s) at transition station: (A) Upstream Lostmans River, (B) Upstream Broad River, (C) Bottle Creek, and (D) Upstream North River; from 2003 to 2011.

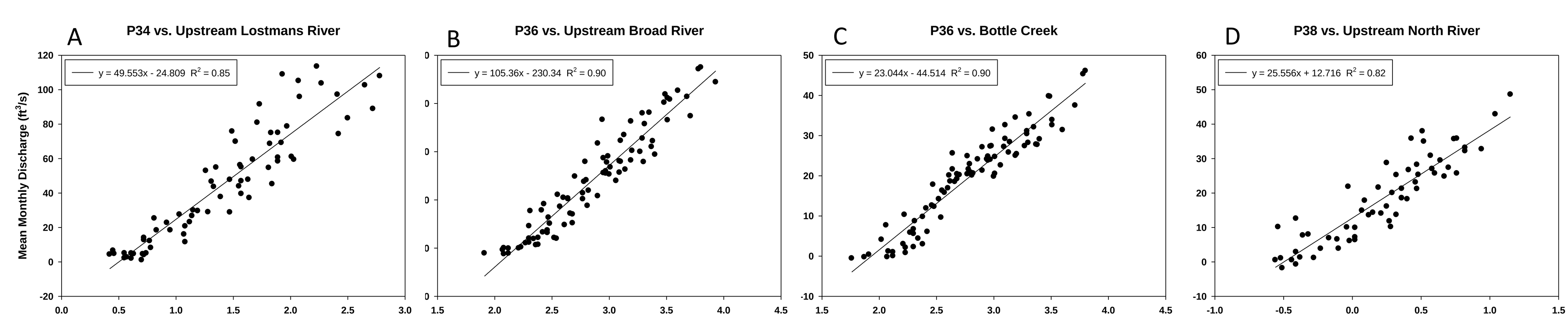

Figure 4. The above graphs represent the relations developed between mean monthly water level (ft, NAVD 88) at the NPS monitoring stations P34, P36, and P38 and the monthly mean discharge (ft^3/s) at transition station: (A) Upstream Lostmans River, (B) Upstream Broad River, (C) Bottle Creek, and (D) Upstream North River; from 2003 to 2011 . Poor correlations were observed when water levels were below ground surface elevations and were therefore removed from model development. Water levels were removed when less than 0.70 ft at P34, 1.97 and 1.76 ft. at P36, and -0.60 ft at P38.

DISCUSSION

The regressions developed for the NPS water level stations, in figure 4, were used to generate time-series graphs (Fig. 5) to compare the predicted and measured monthly flow (acre-feet) from 2004 to 2011, as well as forecast back to 1952. Preliminary results suggest flow to the transition zone after the mid-1990s may have increased as a result of changes in water management operations.

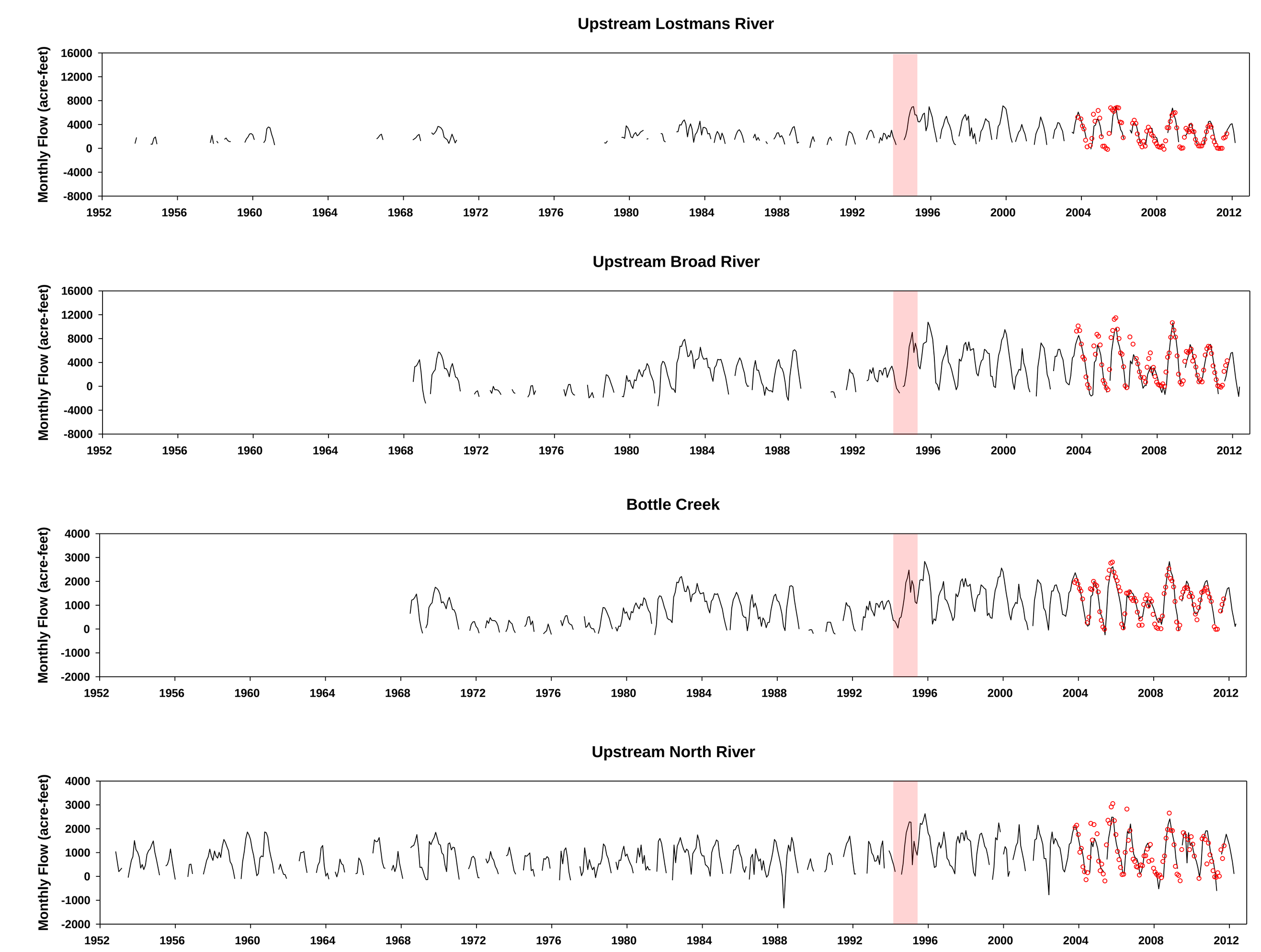

Figure 5. The graphs above show the predicted monthly flow (black line) and the measured monthly flow (red circles) at the USGS monitoring stations. The shaded region indicates a possible increase in predicted flow to the transition zone. Missing record resulted when the water level data was removed during model development.

CONCLUSIONS

The Tamiami Trail Bridge Modifications Project and Decompartmentalization projects are expected to increase water levels and flows in Shark River Slough. Transition stations provide flow volumes at locations where hydrodynamic models are less accurate due to calibration uncertainties near freshwater-seawater boundaries. Monitored flows at the transition zone stations do not represent the total flow volume due to unmeasured sheet flow. Statistical relations between water levels and flows in the transition zone may be useful for monitoring change. Water levels, at selected locations, before and after restoration could serve as a proxy for QQTD of total flow from the transition zone to the coast.

REFERENCES

Levesque, V.A., and Oberg, K.A., 2012, Computing discharge using the index velocity method: U.S. Geological Survey Techniques and Methods 3–A23, 148 p. (http://pubs.usgs.gov/tm/3a23/.)

USGS Memo SW10.08 Processing and Publication of Discharge and Stage Data Collected in Tidally-Influenced Areas *(Revised 9-26-11)*

ACKNOWLEDGEMENTS

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