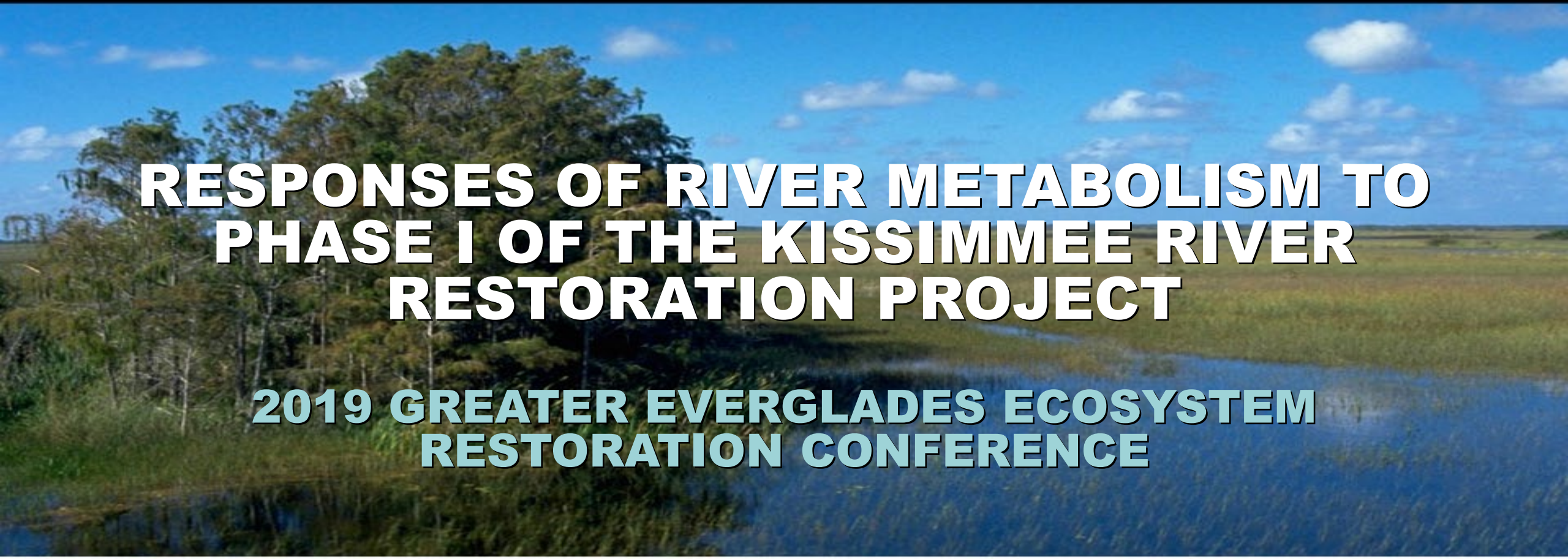

RESPONSES OF RIVER METABOLISM TO PHASE I OF THE KISSIMMEE RIVER RESTORATION PROJECT

2019 GREATER EVERGLADES ECOSYSTEM RESTORATION CONFERENCE

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April 24, 2019

Objective of this study

To evaluate **functional changes** as a result of the Phase I construction of the Kissimmee River Restoration Project (KRRP) in terms of gross primary production (GPP), ecosystem respiration (ER) and net ecosystem production (NEP).

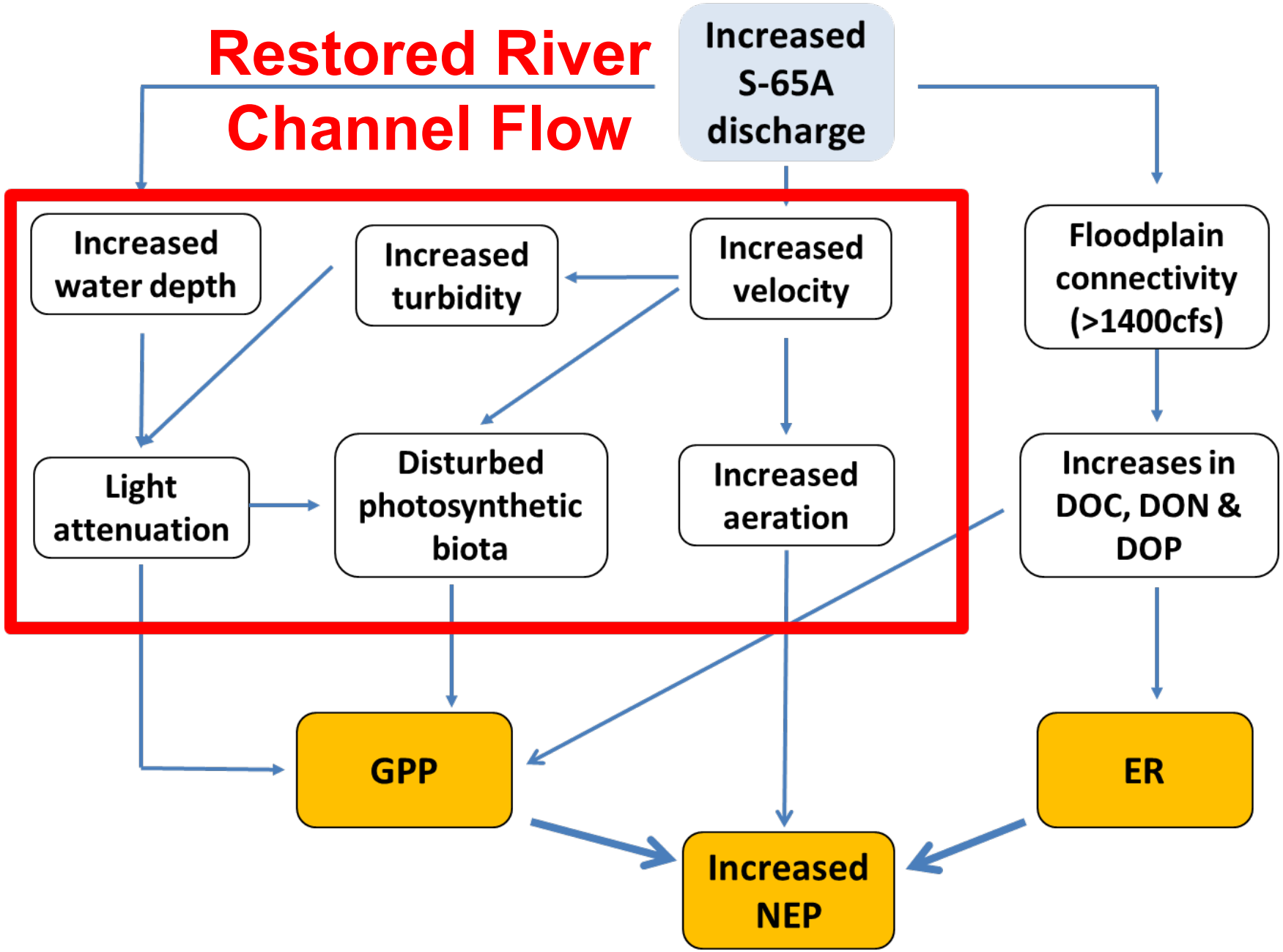
ER, GPP, and NEP represent an integrated measure of production and consumption of organic matter in a system (Odum 1971).

Hypotheses

Hypothesis 1: Restored river channel flow will increase NEP in the Phase I area of the KRRP.

Hypothesis 2: Rapidly increasing discharge will decrease NEP in the wet season.

Conceptual relationships between flow and metabolism in the river



The River was channelized in 1971

The remnant river channel had:

- Little or no flow
- Encroached vegetation
- Organic deposition layer
- Chronically low dissolved oxygen (DO)

C-38 Canal

Remnant River Channel

Phase I construction of the KRRP completed in 2001

Restored flow has greatly improved DO concentrations

Dissolved Oxygen Data Collection

Continuous monitoring of DO was conducted using a stationary sonde at a depth of 0.5−1 m below the water surface in the Phase I river channel at taking measurements at 15-minute intervals.

- Baseline period: January 1998 – May 1999
- Post-construction period: 2006 – 2016

Metabolism estimates (Odum 1956, Bott 2007)

Estimates of ER, GPP and NEP were derived using the single station oxygen curve method based on the following equation:

$$\frac{\Delta O_2}{\Delta t} = GPP - ER + k(C_s - C)$$

where O_2 and C are DO concentrations measured by the sonde, k is the reaeration coefficient and C_s is the DO concentration corresponding to saturation.

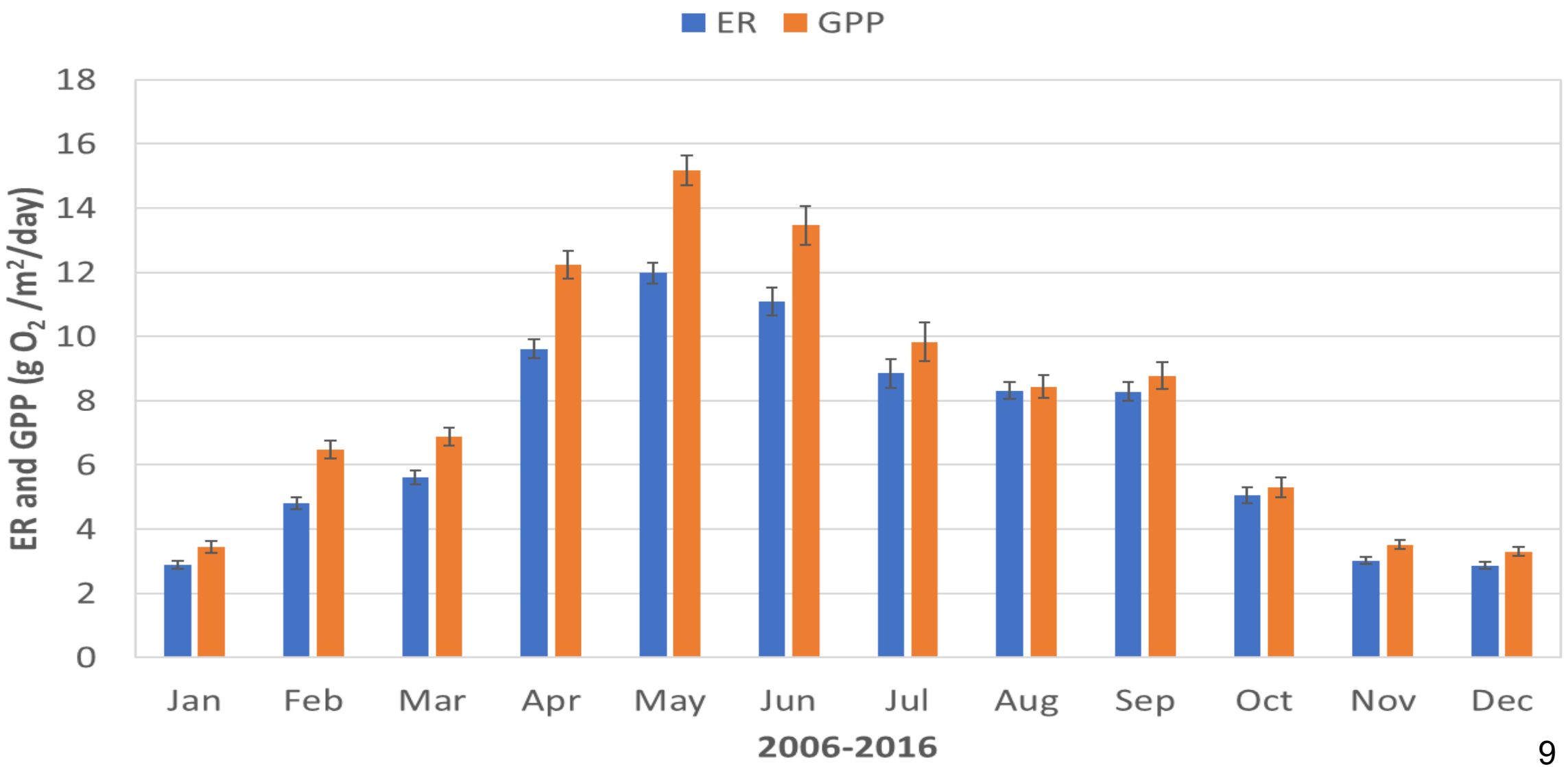
- ER (g O_2 /m^2/day) was calculated as the average $\frac{\Delta O_2}{\Delta t}$ during nighttime hours and extrapolated to 24 hours.
- GPP was calculated as the sum of net production of O_2 during daytime hours and average nighttime respiration rate multiplied by the length of the daytime period.
- NEP = GPP - ER

Effect of Restored River Channel Flow

Period	Dissolved oxygen (DO)	Ecosystem respiration (ER)	Gross primary production (GPP)	Net ecosystem production (NEP)
Baseline 1998-1999	1.24 ± 0.06	0.80 ± 0.04	1.57 ± 0.09	0.77 ± 0.06
Post-Construction 2006-2016	4.74 ± 0.04	7.28 ± 0.11	8.61 ± 0.14	1.32 ± 0.06

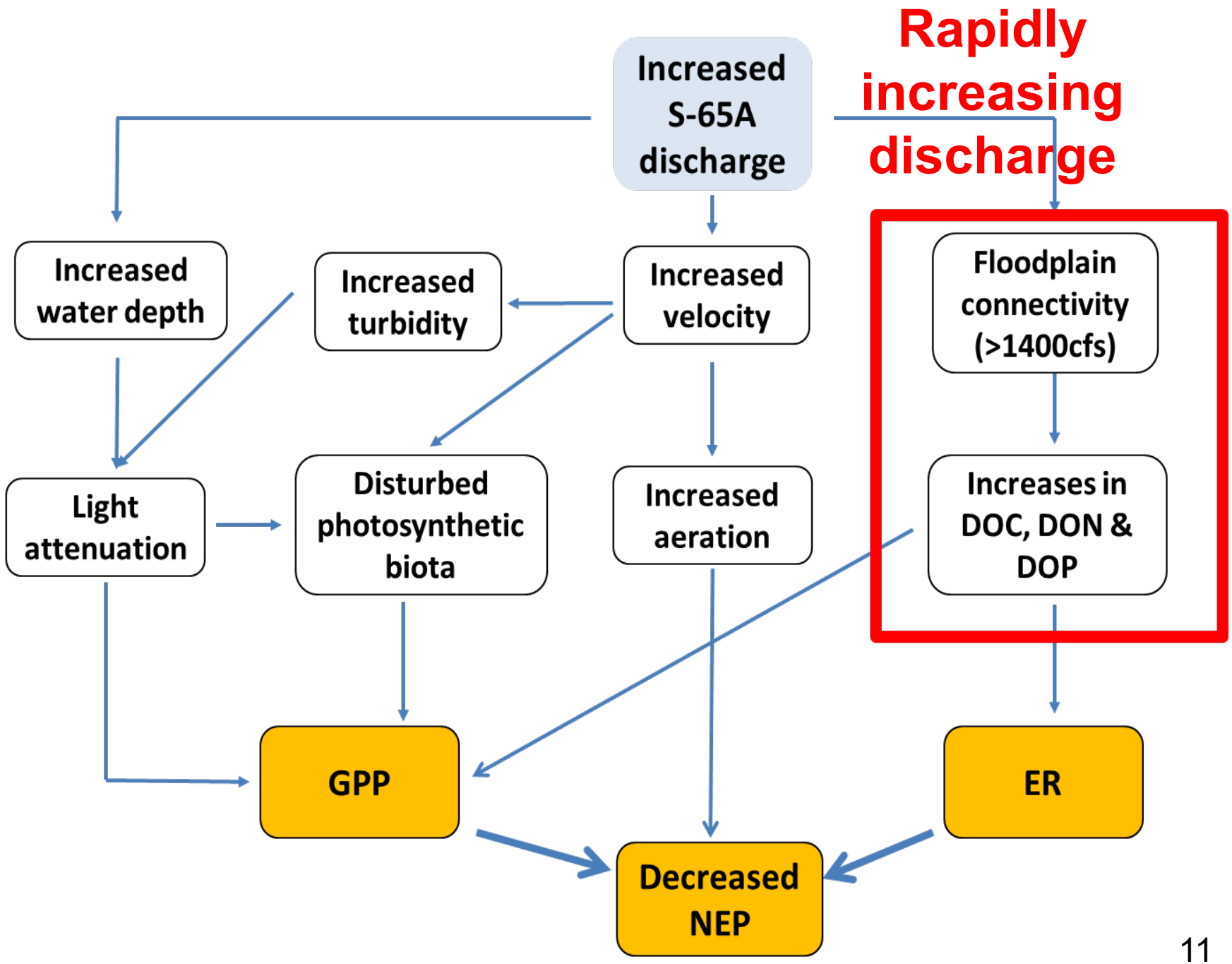
(Mean ± SE)

Monthly ER and GPP Have a Seasonal Pattern

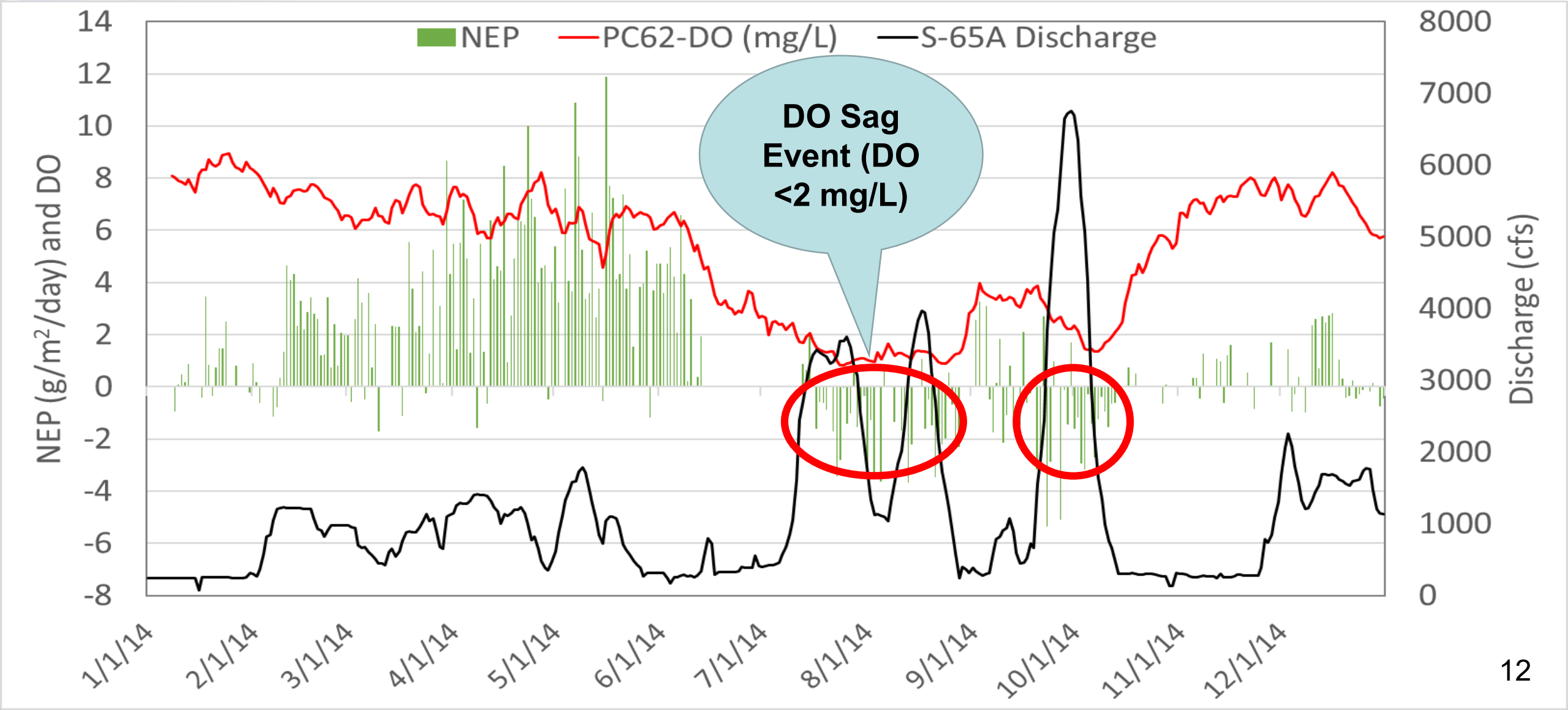


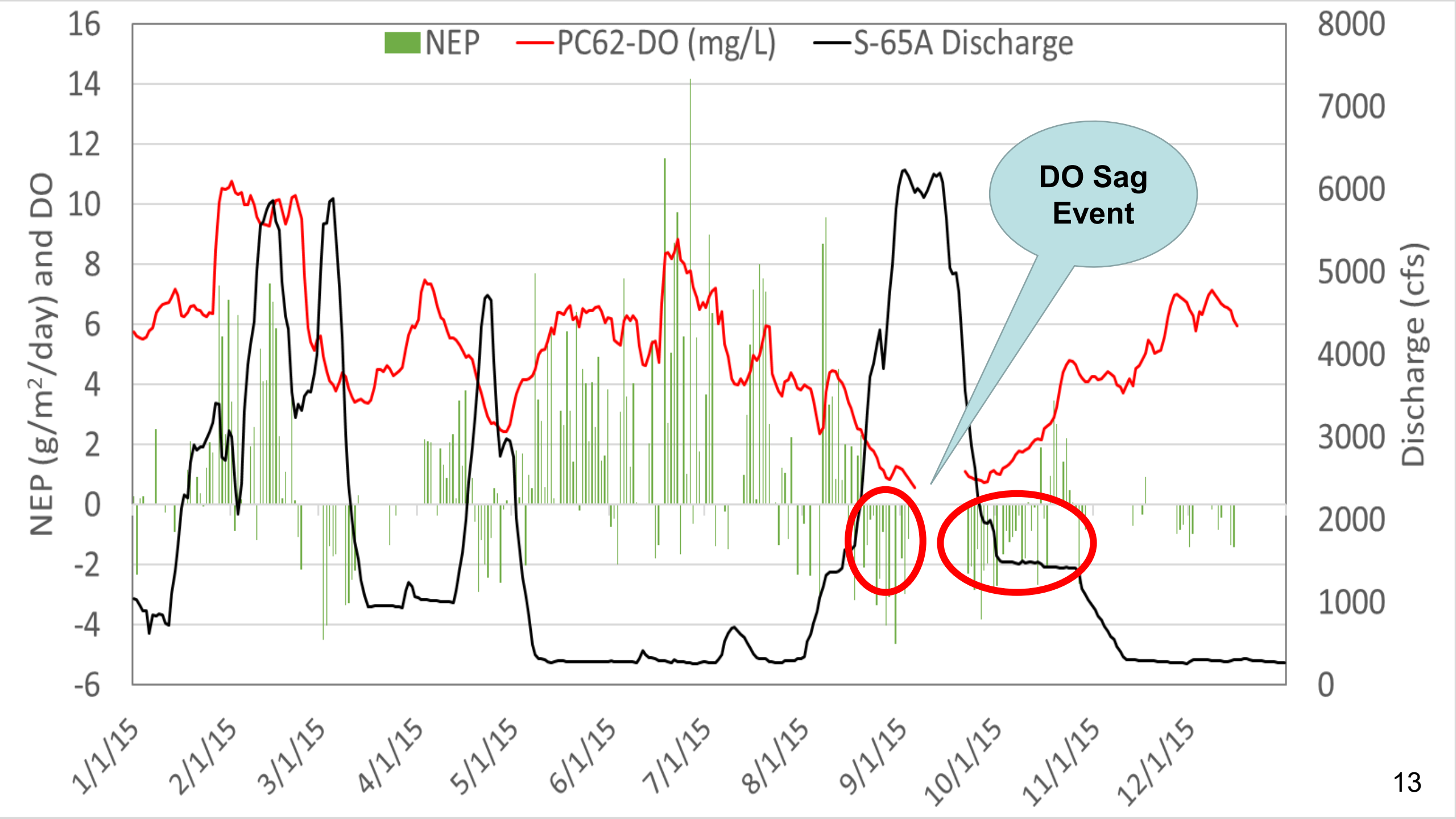
How did rapidly increasing S-65A discharge affect NEP in the Kissimmee River during the wet season (June to October)?

Conceptual relationships between flow and metabolism in the river



High Discharge Decreased NEP in DO Sag Events




NEP
PC62-DO (mg/L)
S-65A Discharge
DO Sag Event
NEP (g/m²/day) and DO
Discharge (cfs)
16
14
12
10
8
6
4
2
0
-2
-4
-6
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1/15
2/1/15
3/1/15
4/1/15
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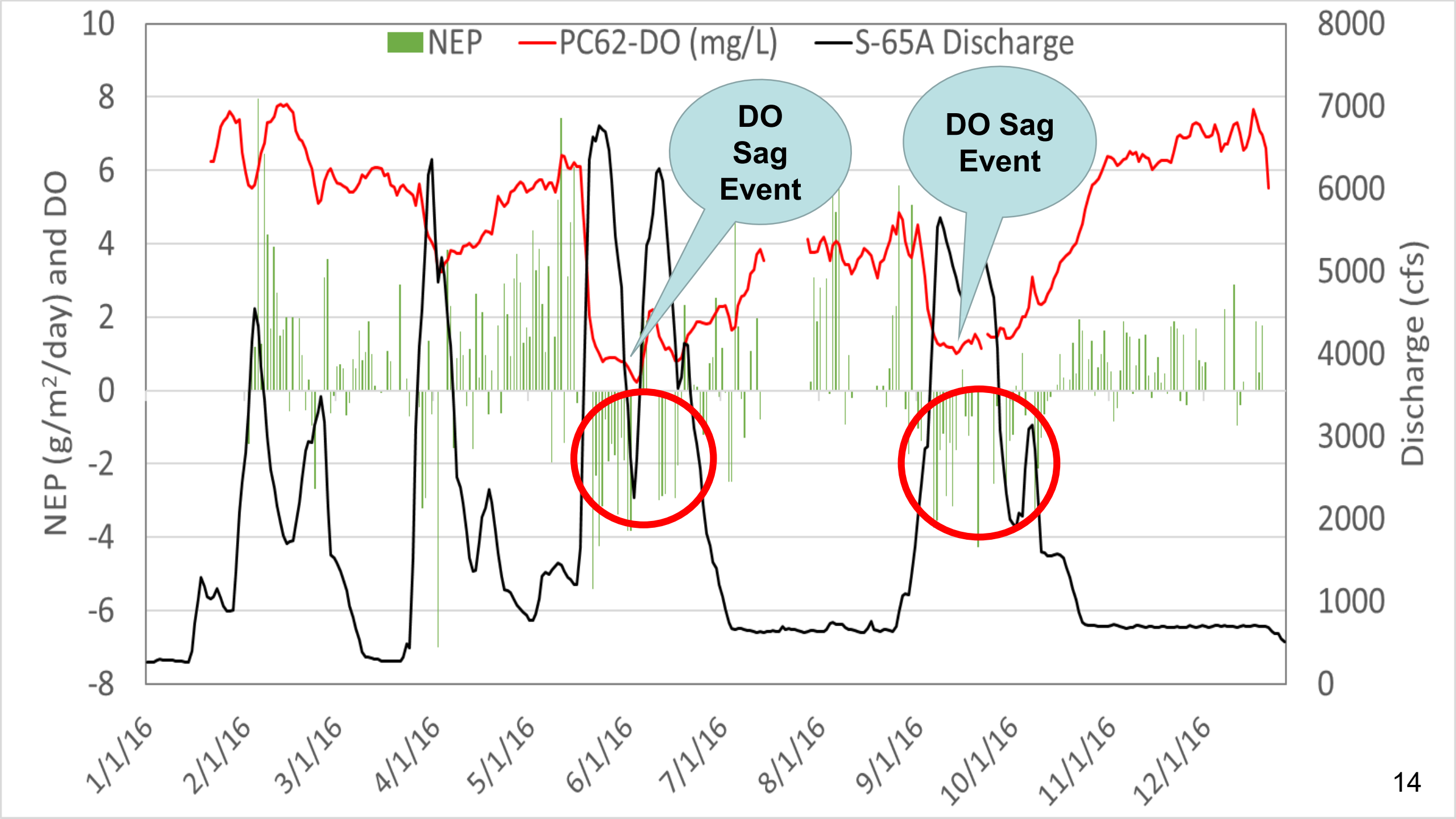
9/1/15
10/1/15
11/1/15
12/1/15


NEP
PC62-DO (mg/L)
S-65A Discharge
DO Sag Event
DO Sag Event
NEP (g/m²/day) and DO
Discharge (cfs)
10
8
6
4
2
0
-2
-4
-6
-8
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1/16
2/1/16
3/1/16
4/1/16
5/1/16
6/1/16
7/1/16
8/1/16
9/1/16
10/1/16
11/1/16
12/1/16

Conclusions

- Reestablished river flow increased GPP, ER and NEP in the post-construction period compared with the baseline.
- Monthly ER and GPP in the river channel had a seasonal pattern after reestablished flow.
- Rapidly increased S-65A discharge resulted in decreased NEP, particularly during DO sag events in the wet season.
- The impact of rapidly-increasing S-65A discharge to ER relative to GPP likely caused DO to decline in the river channel.