

# Stream-Associated Amphibian Response to Manipulation of Forest Canopy Shading



James G MacCracken  
Jennifer L Stebbings



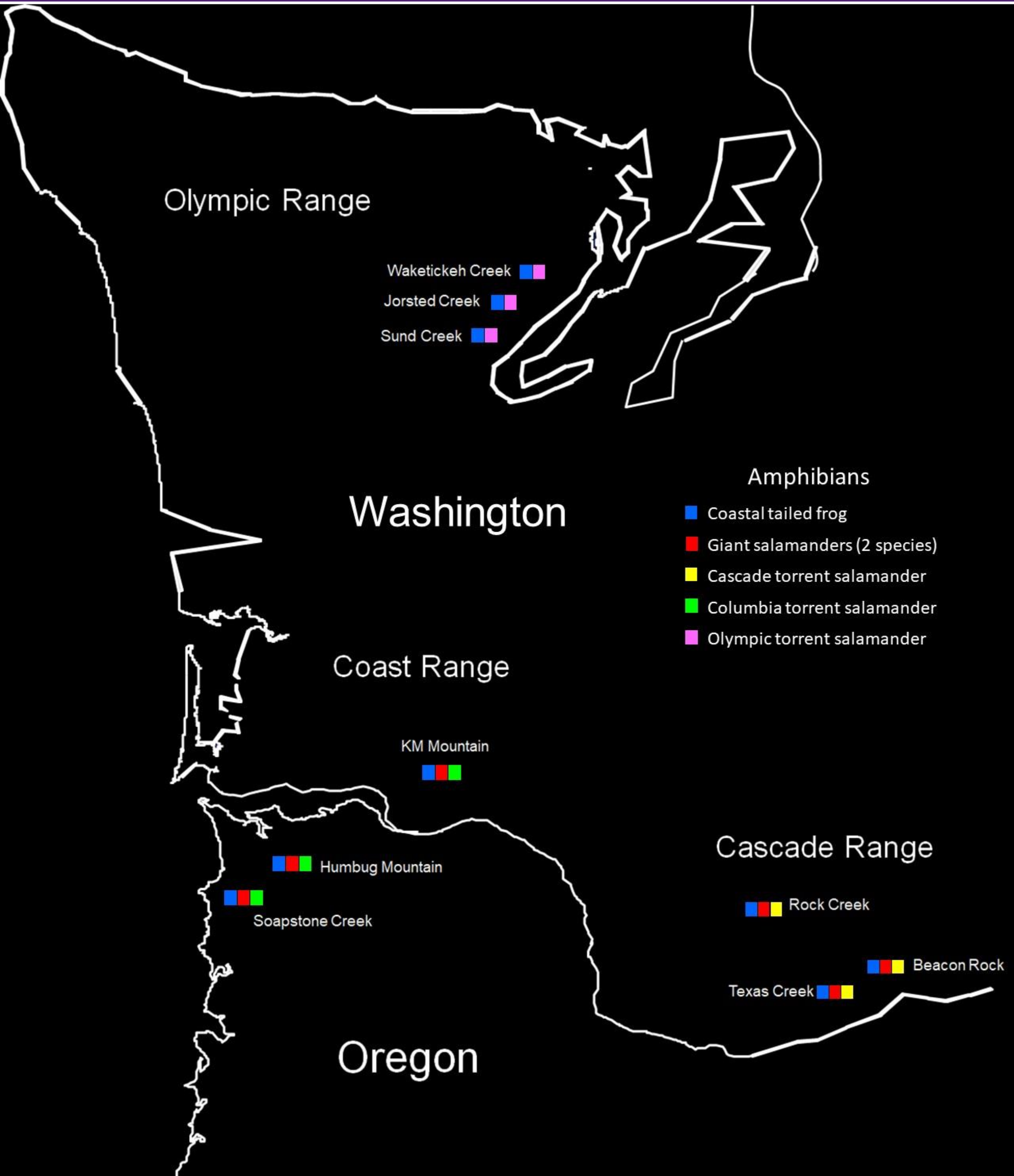
Marc P Hayes  
Julie A Tyson



Forests & Fish  
—  
Adaptive  
Management  
Program



# Study Area & Focal Species

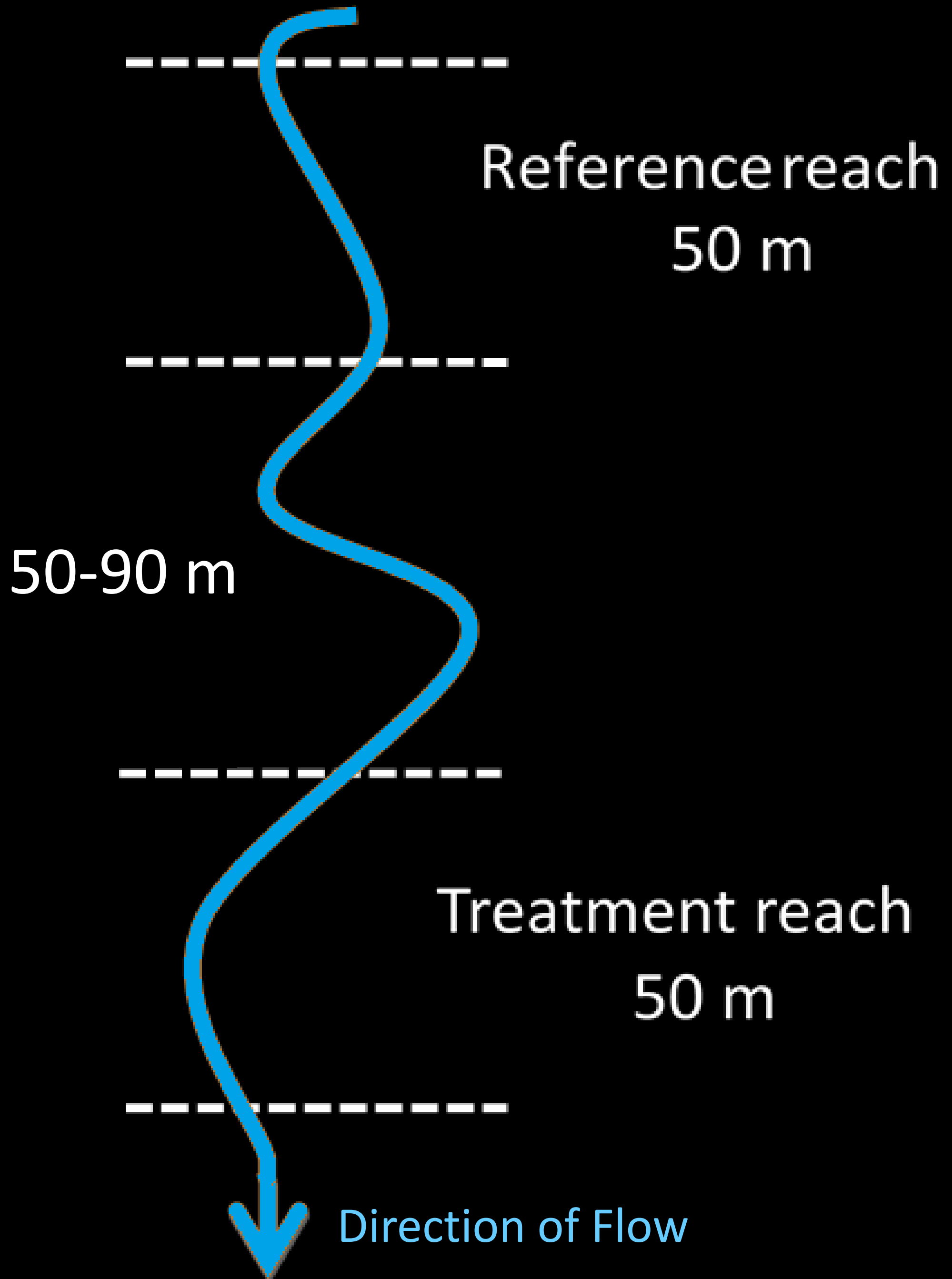




# Study Treatments

<b>Shade Reduction Treatment</b>	<b>Treatment Target (% overhead cover)</b>	<b>Actual Treatment (% overhead cover; <math>\bar{x} \pm SE</math>)</b>	<b>Sample Size (n =)</b>
<b>Intermediate</b>	70	$77 \pm 3$	8
<b>Low</b>	30	$61 \pm 3$	9
<b>No</b>	0	$40 \pm 4$	8
<b>Reference</b>	Unmanipulated	Unmanipulated	25

# Treatment Stream Configuration





# Treatment Example

—

## Intermediate Shade Reduction Treatment Olympic Block



Pre



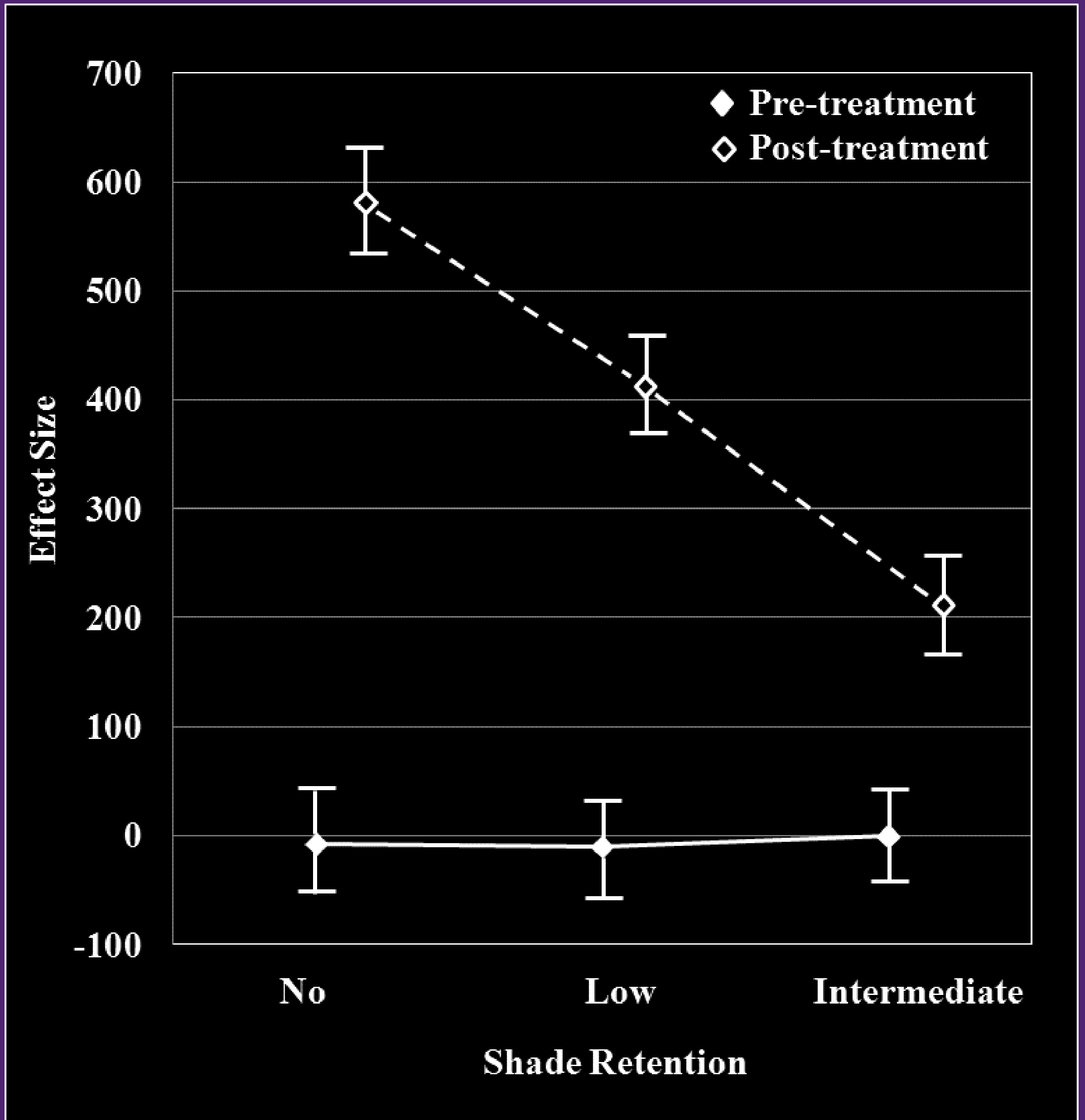
Post



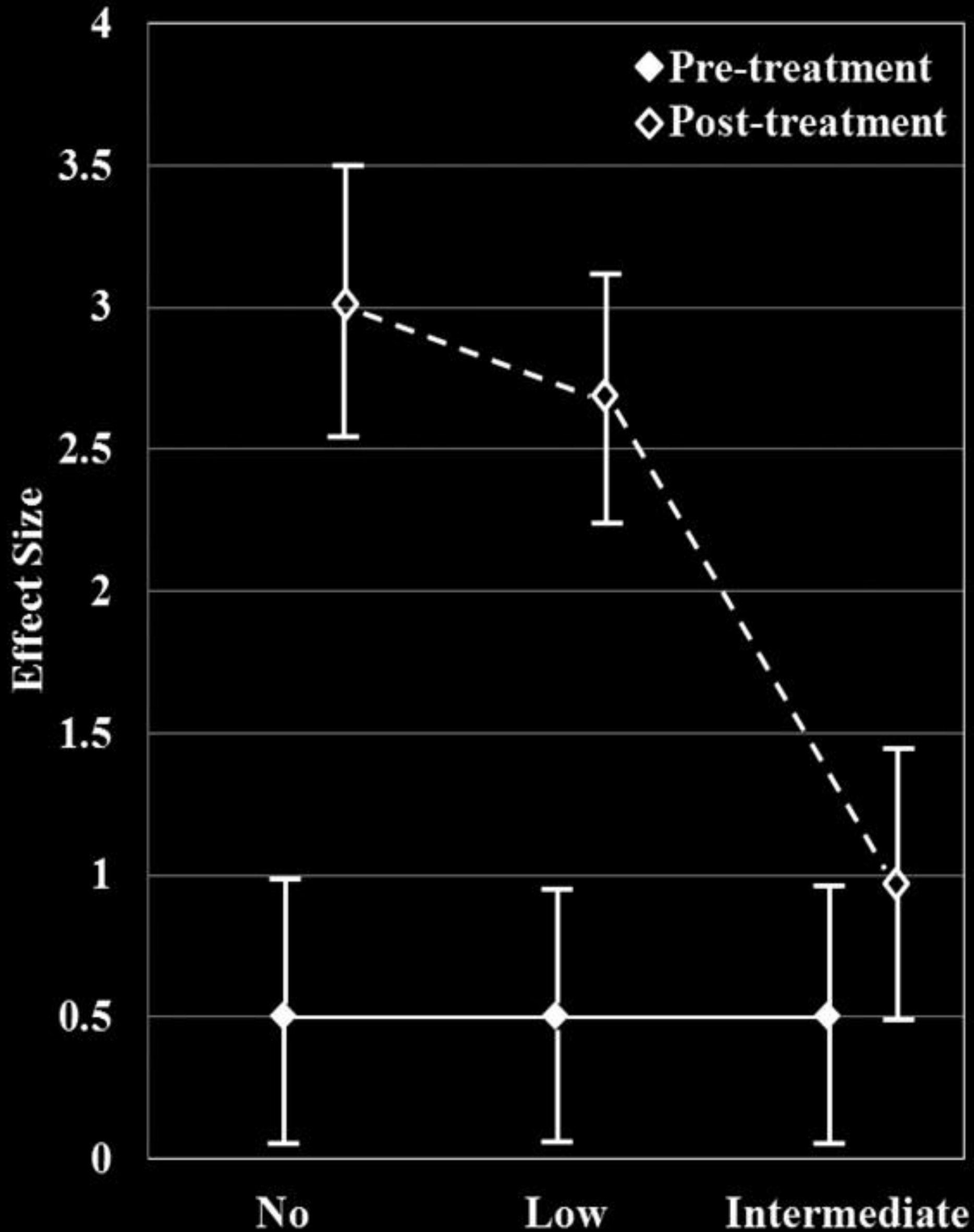
# Study Timelines & Variables

Blocks	NW Oregon SW Washington	Pre-Treatment	Trtmt	Post-Treatment			
	Olympics			Pre-Treatment	Trtmt	Post-Treatment	
Variables	Year	2004	2005	2006	2007	2008	2009
Vegetation Cover		X	X	X (X)	X (X)	(X)	(X)
Light (as PAR - Photosynthetically Active Radiation)		X	X	X (X)	X (X)	(X)	(X)
Water Temperature		X	X	X (X)	X (X)	(X)	(X)
Biofilm/Periphyton		X	X	X (X)	X (X)	(X)	(X)
Stream Drift (Detritus, Macroinvertebrates)		X	X	X (X)	X (X)	(X)	(X)
Amphibians	Abundance	X	X	X (X)	X (X)	(X)	(X)
	Body Condition	X	X	X (X)	X (X)	(X)	(X)
	Growth	X	X	X (X)	X (X)	(X)	(X)

# PAR (Photosynthetically Active Radiation)

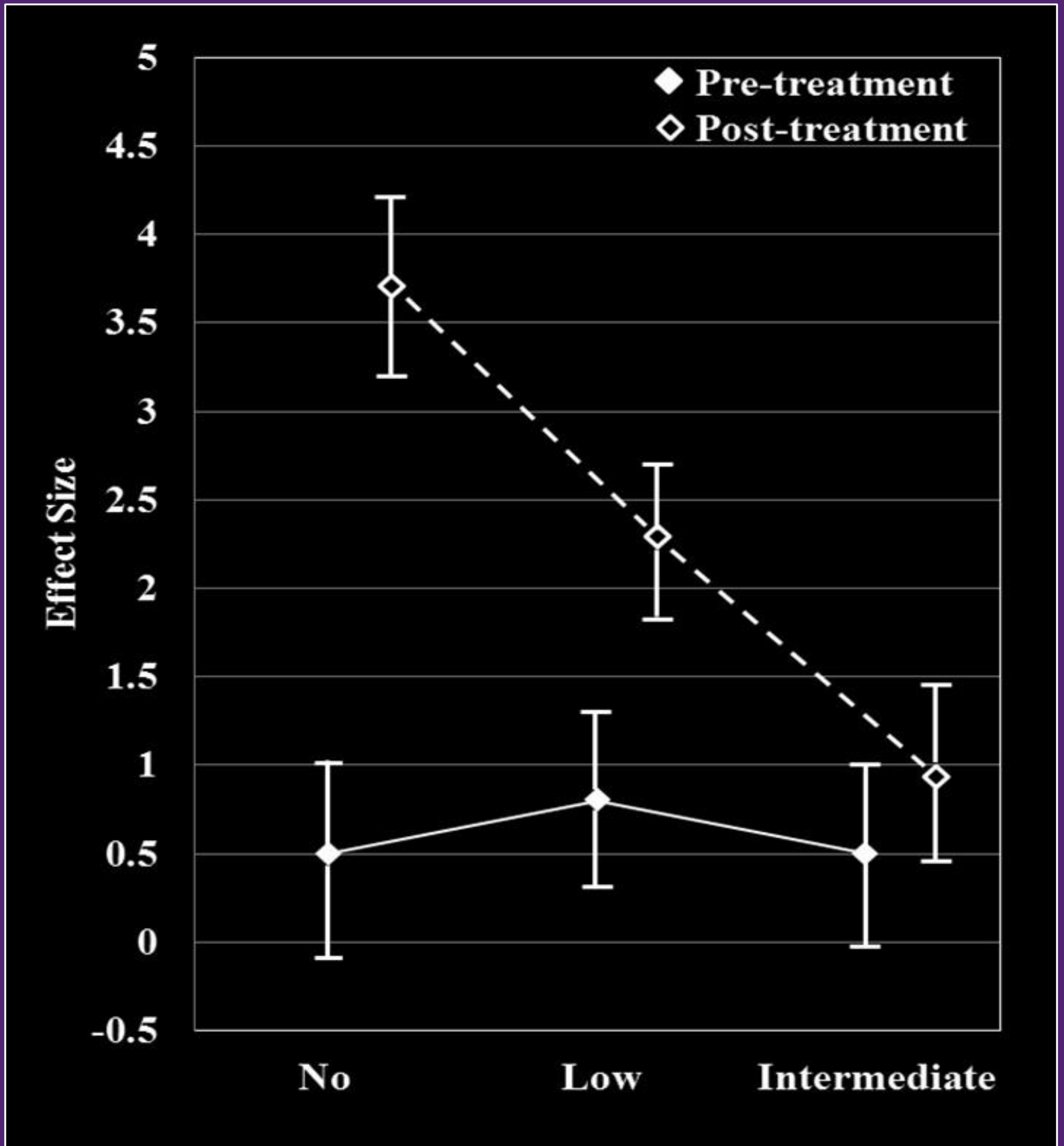


# Water Temperature (Seasonal 7-day Moving Average Maximum)

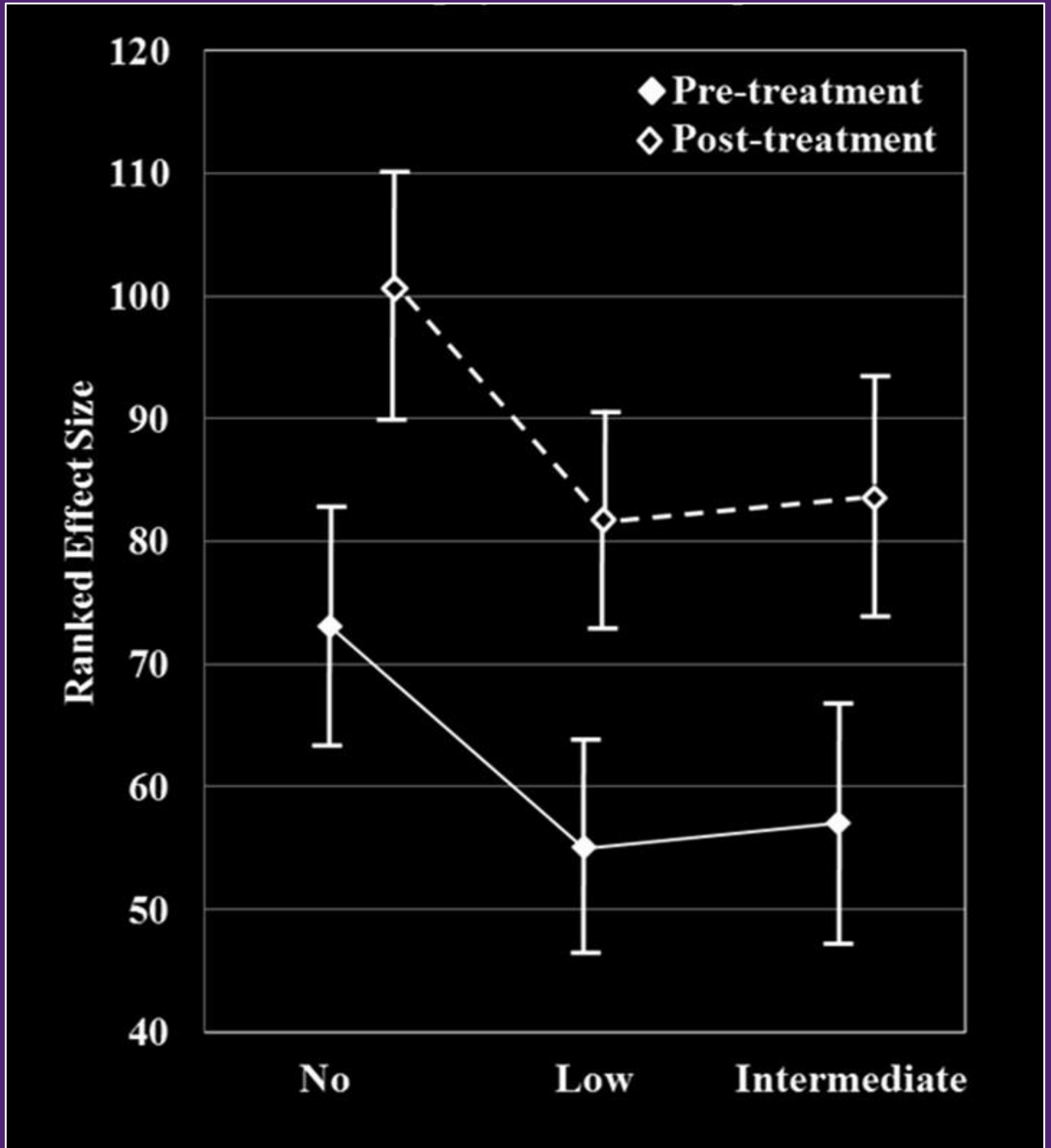




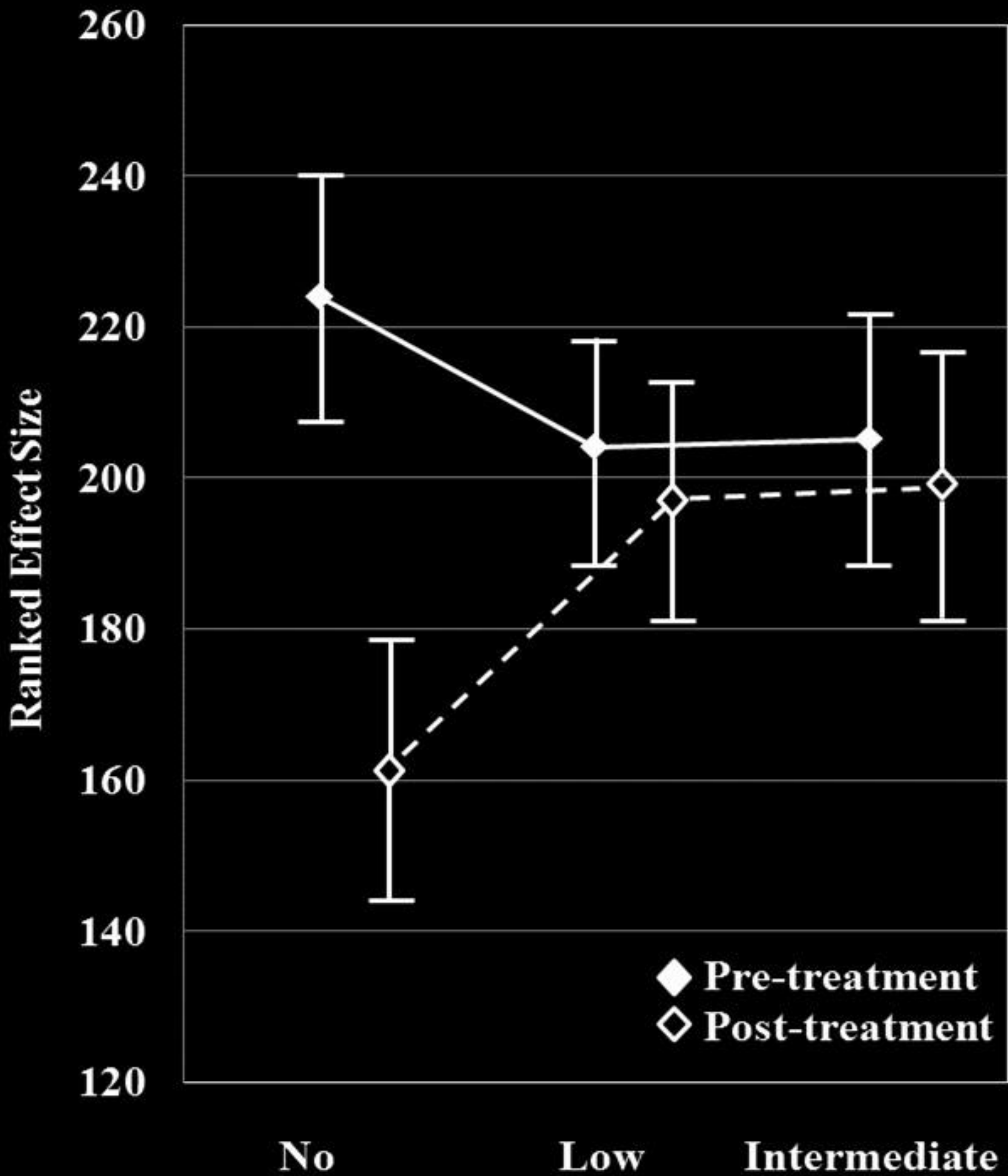
# Water Temperature (Seasonal Mean Maximum)



# Variation in Biofilm Accrual

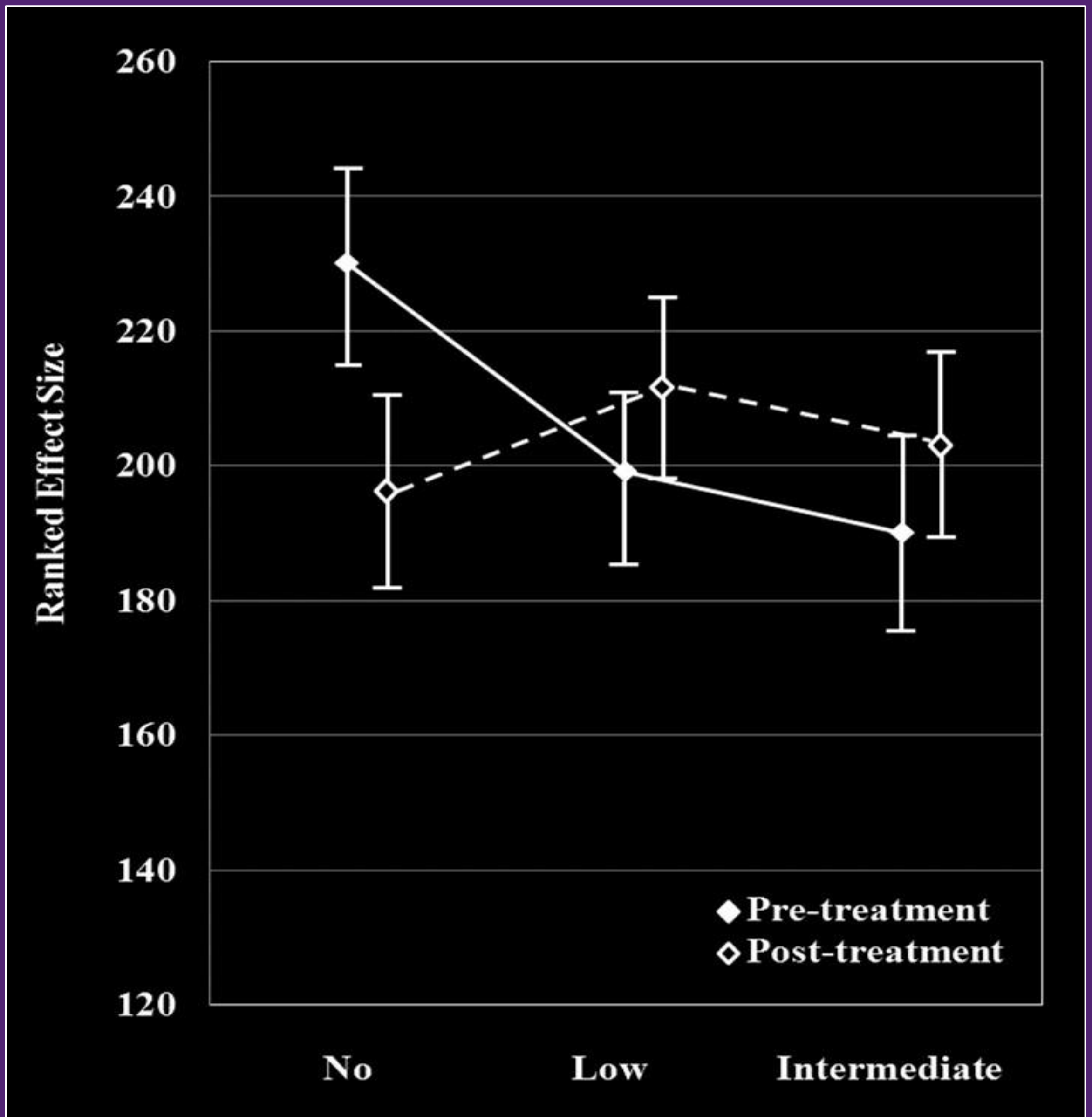


# Variation in Coarse Particulate Organic Matter Drift

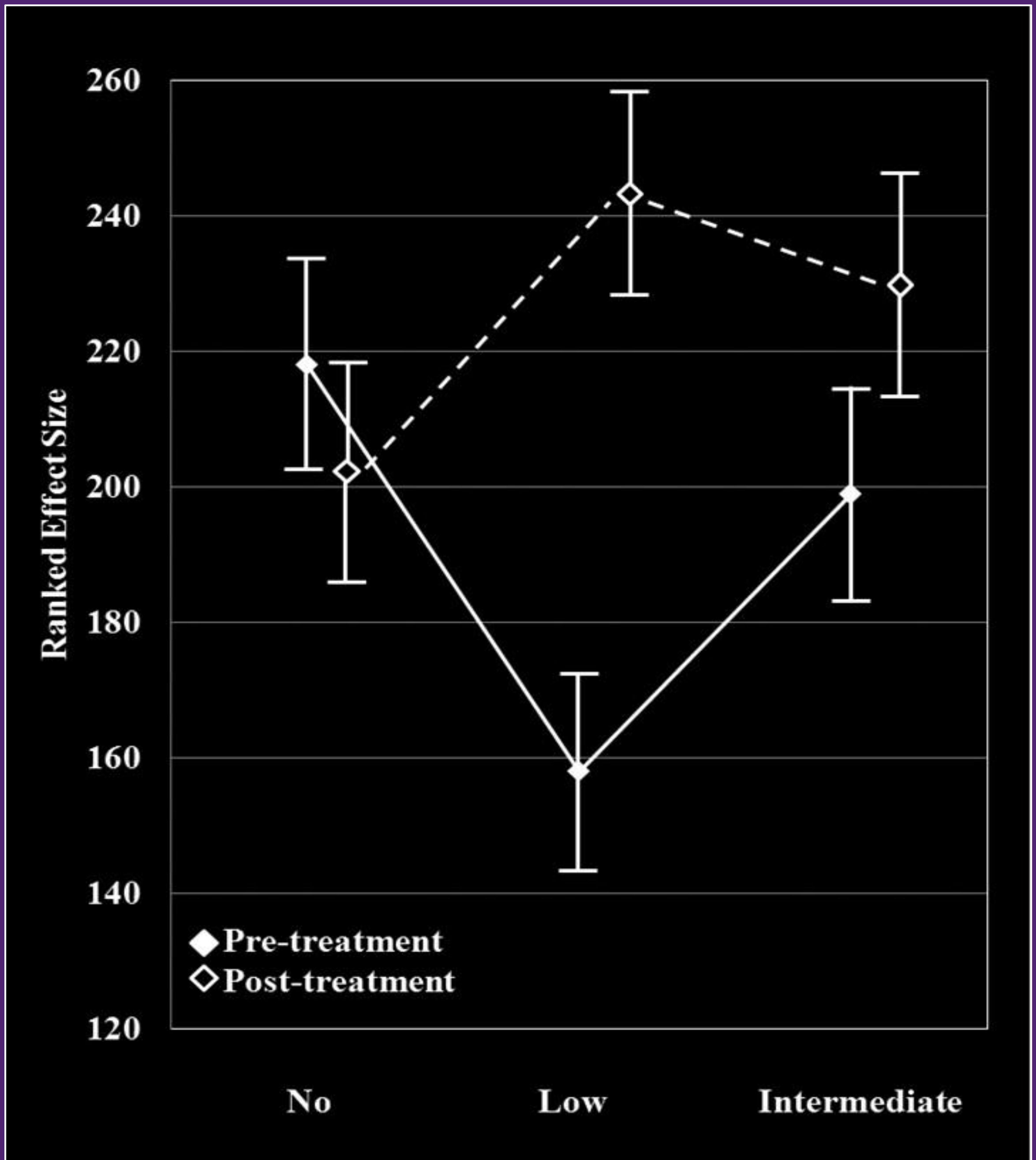




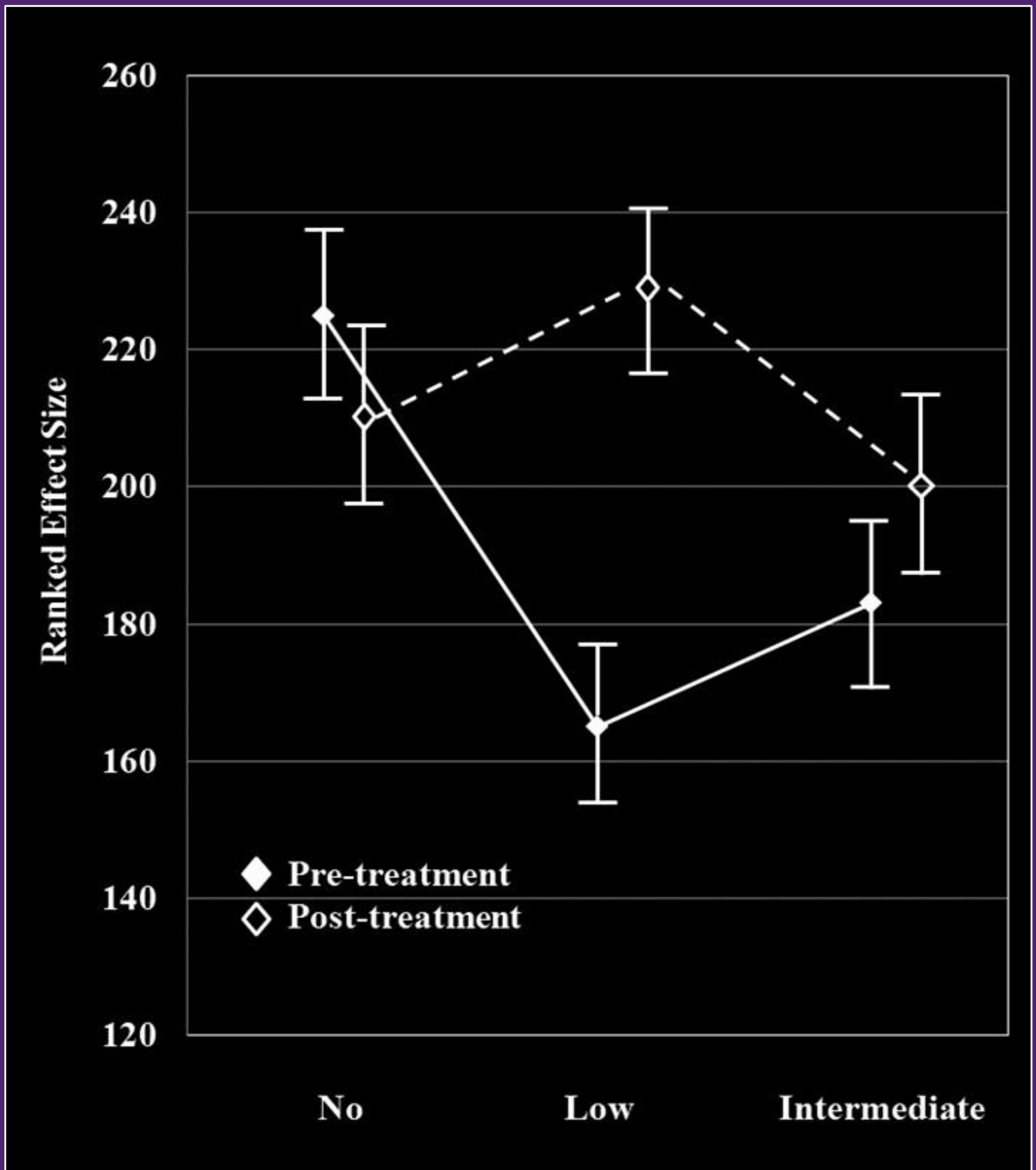
# Variation in Fine Particulate Organic Matter Drift



# Variation in Macroinvertebrate Gathering Collector Drift

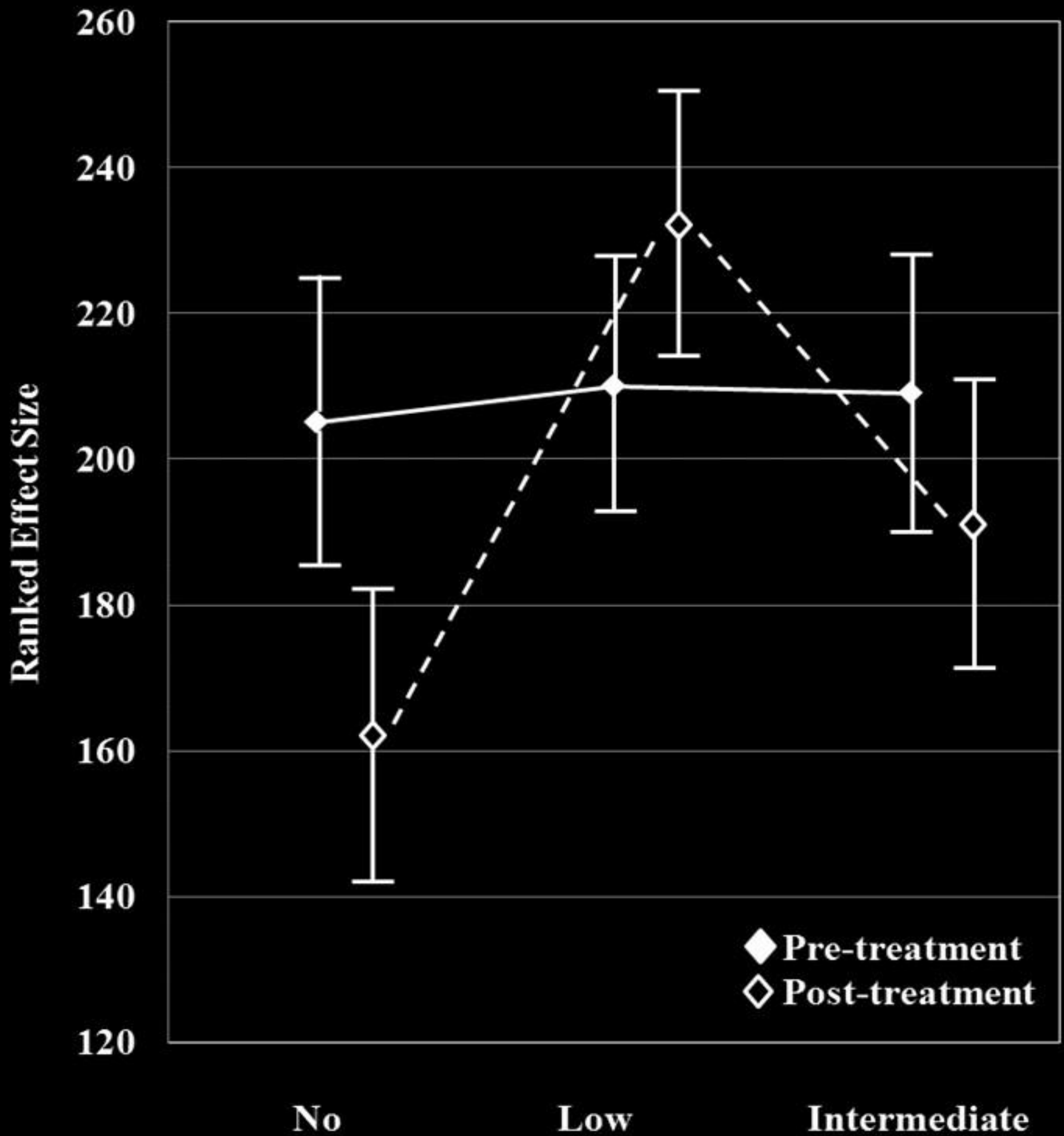


# Variation in Macroinvertebrate Gathering Collector Drift 2

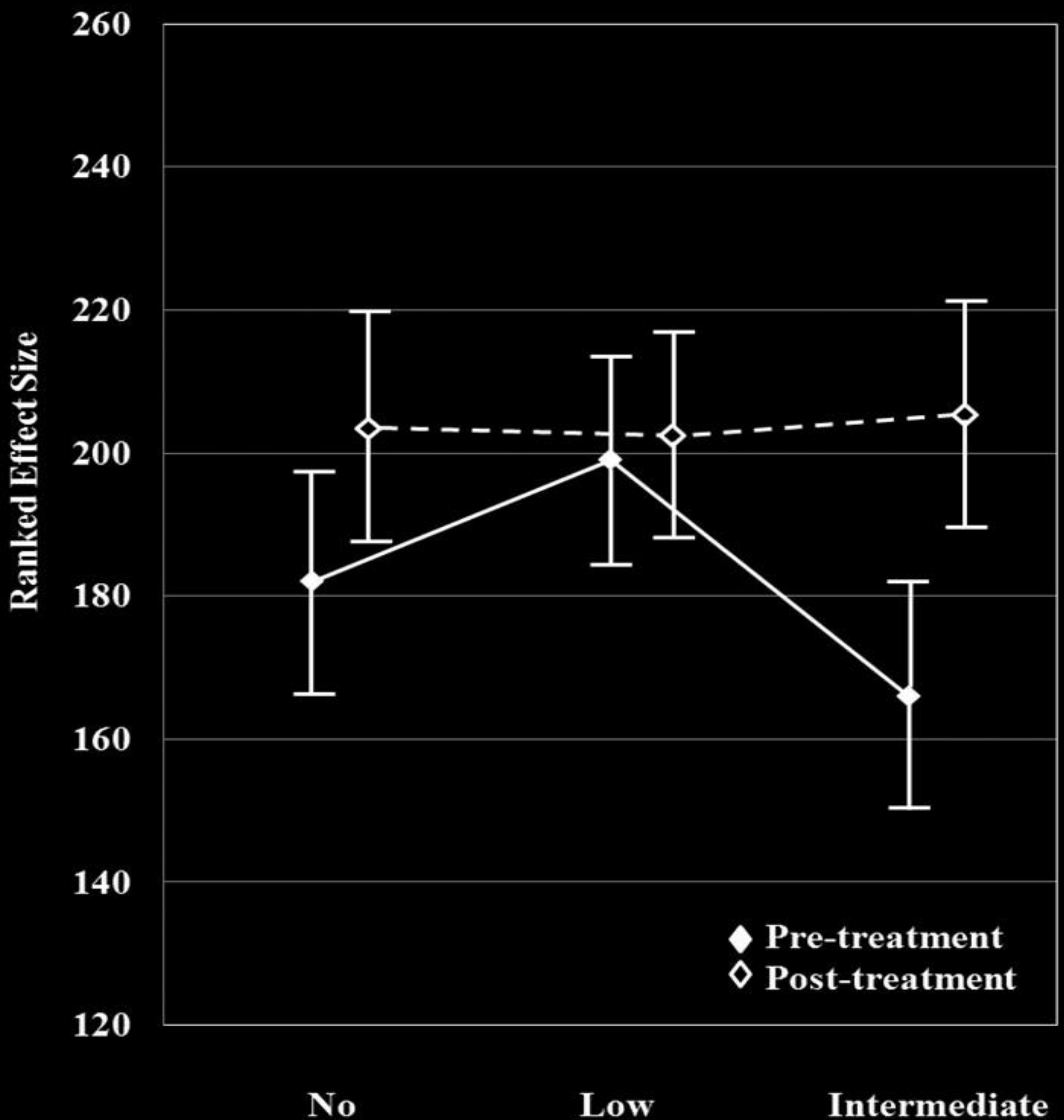




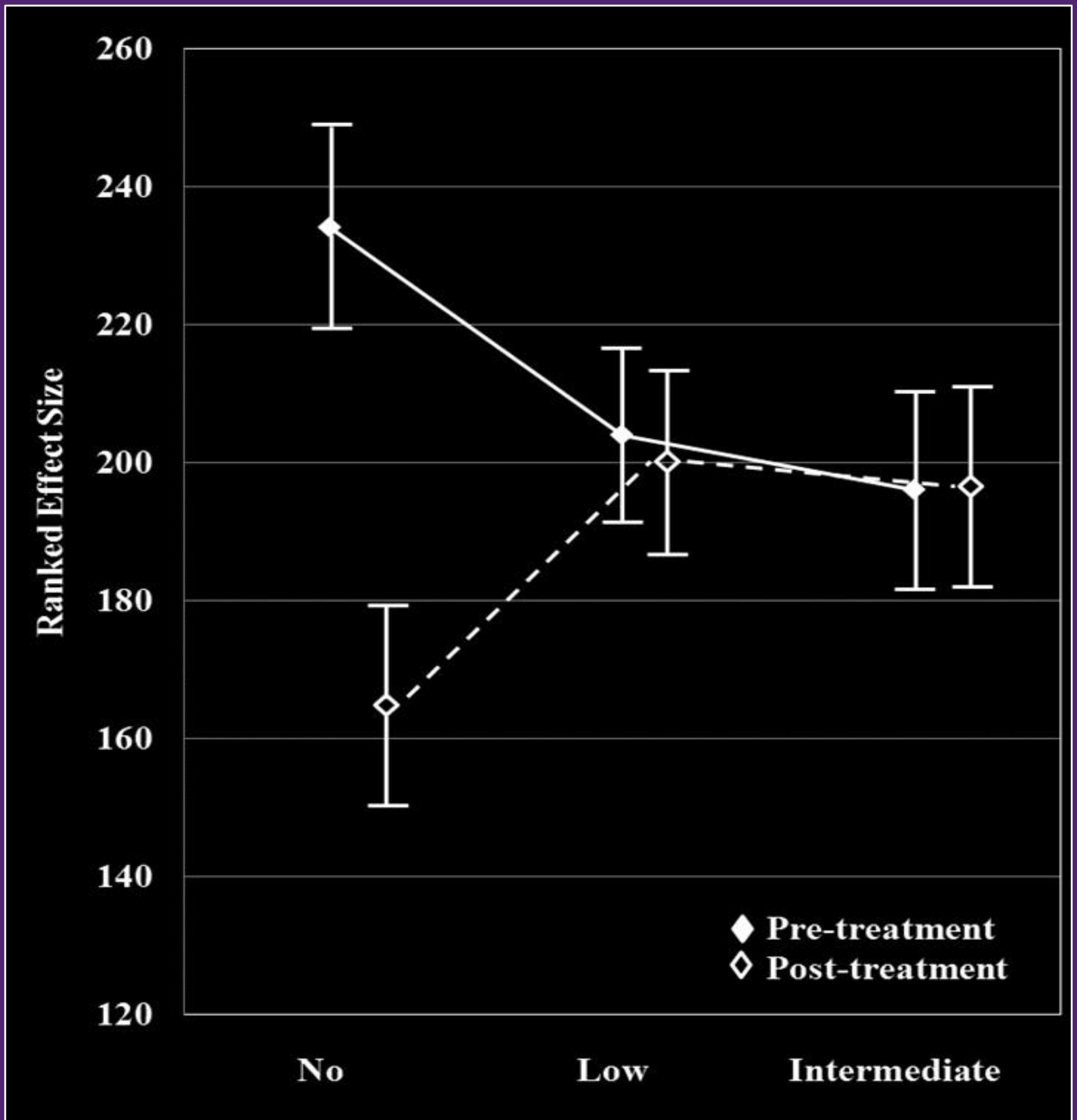
# Variation in Macroinvertebrate Predator Drift



# Variation in Macroinvertebrate Scraper Drift

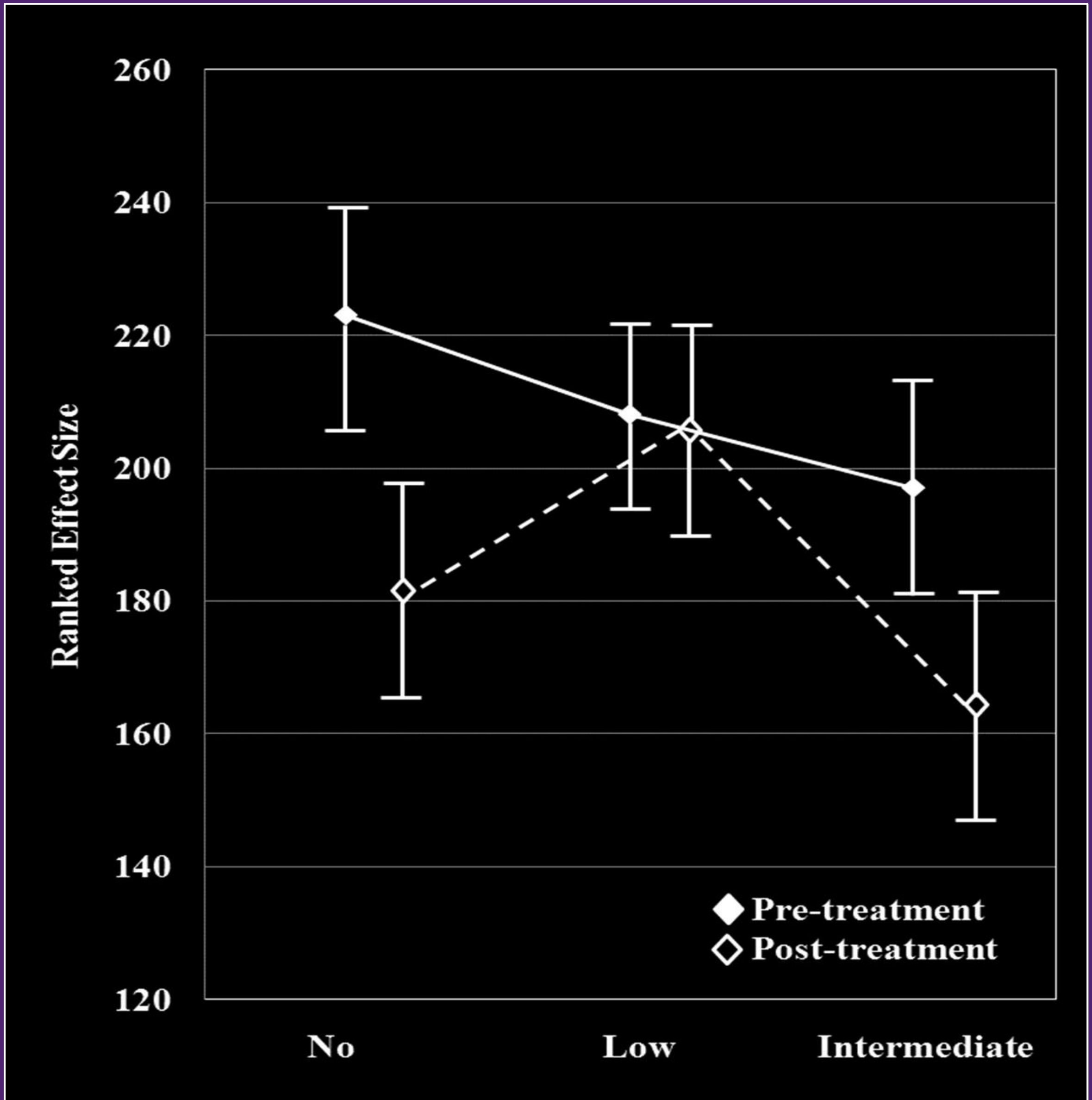


# Variation in Macroinvertebrate Shredder Drift

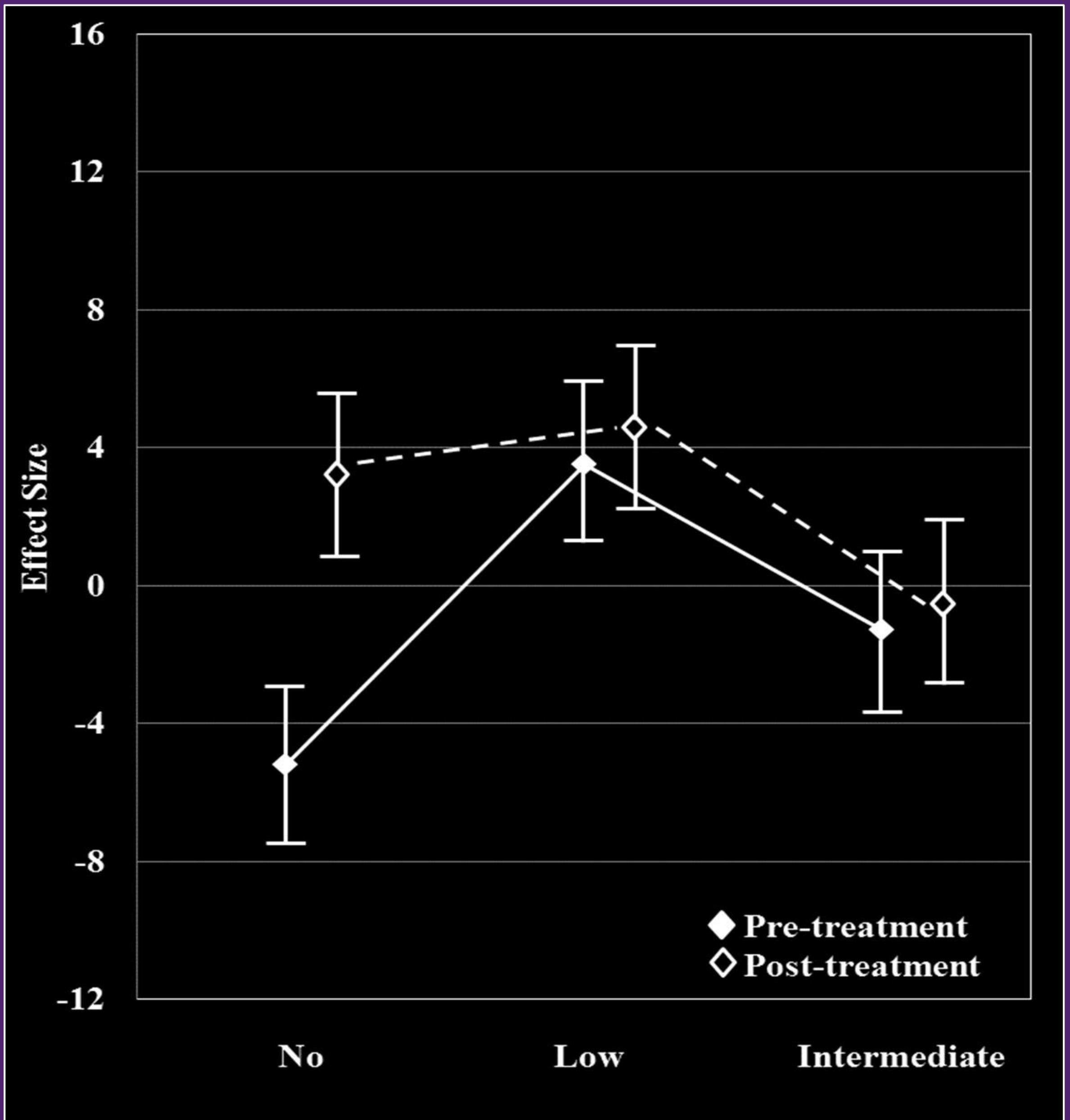




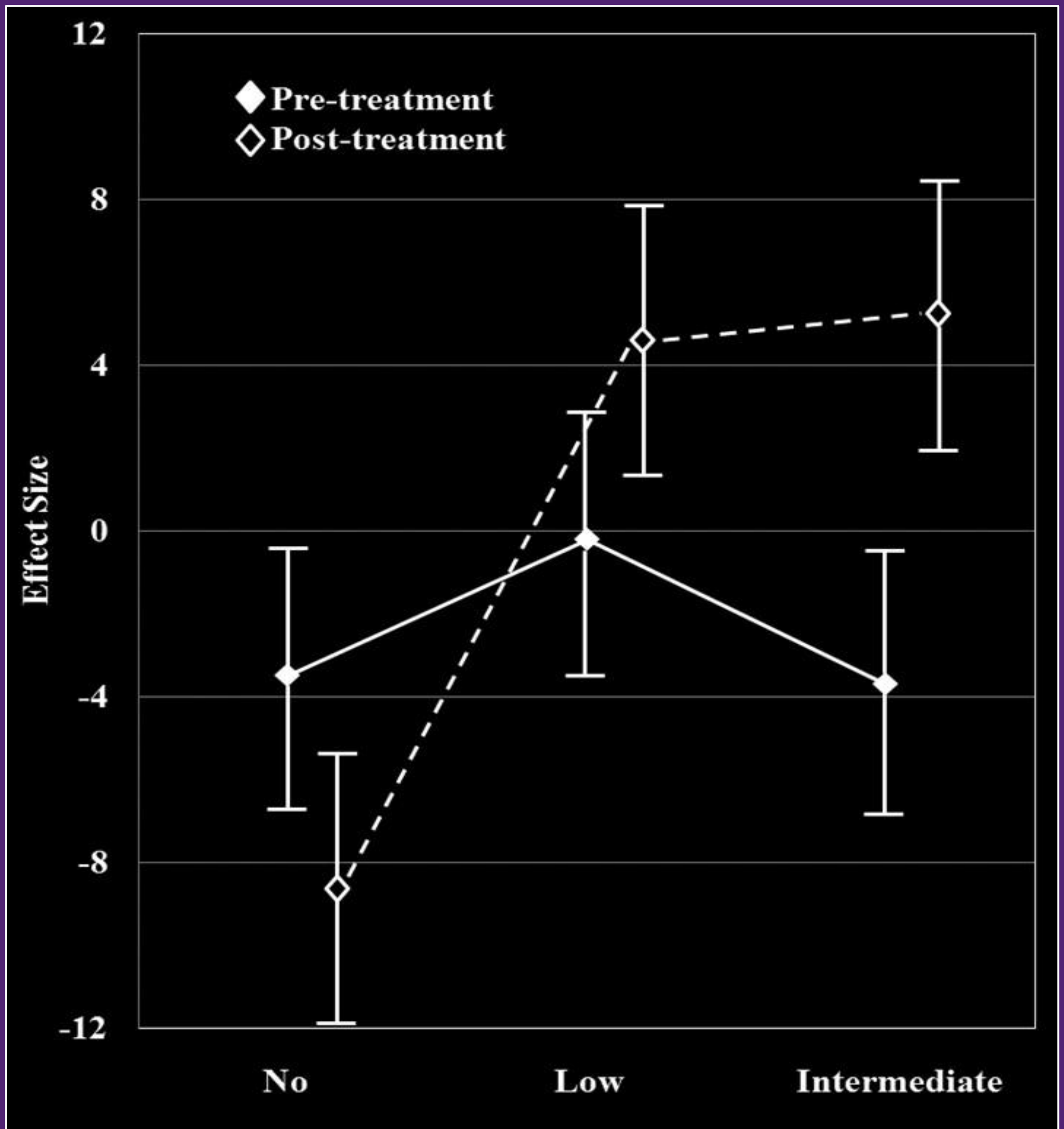
# Variation in Total Macroinvertebrate Drift



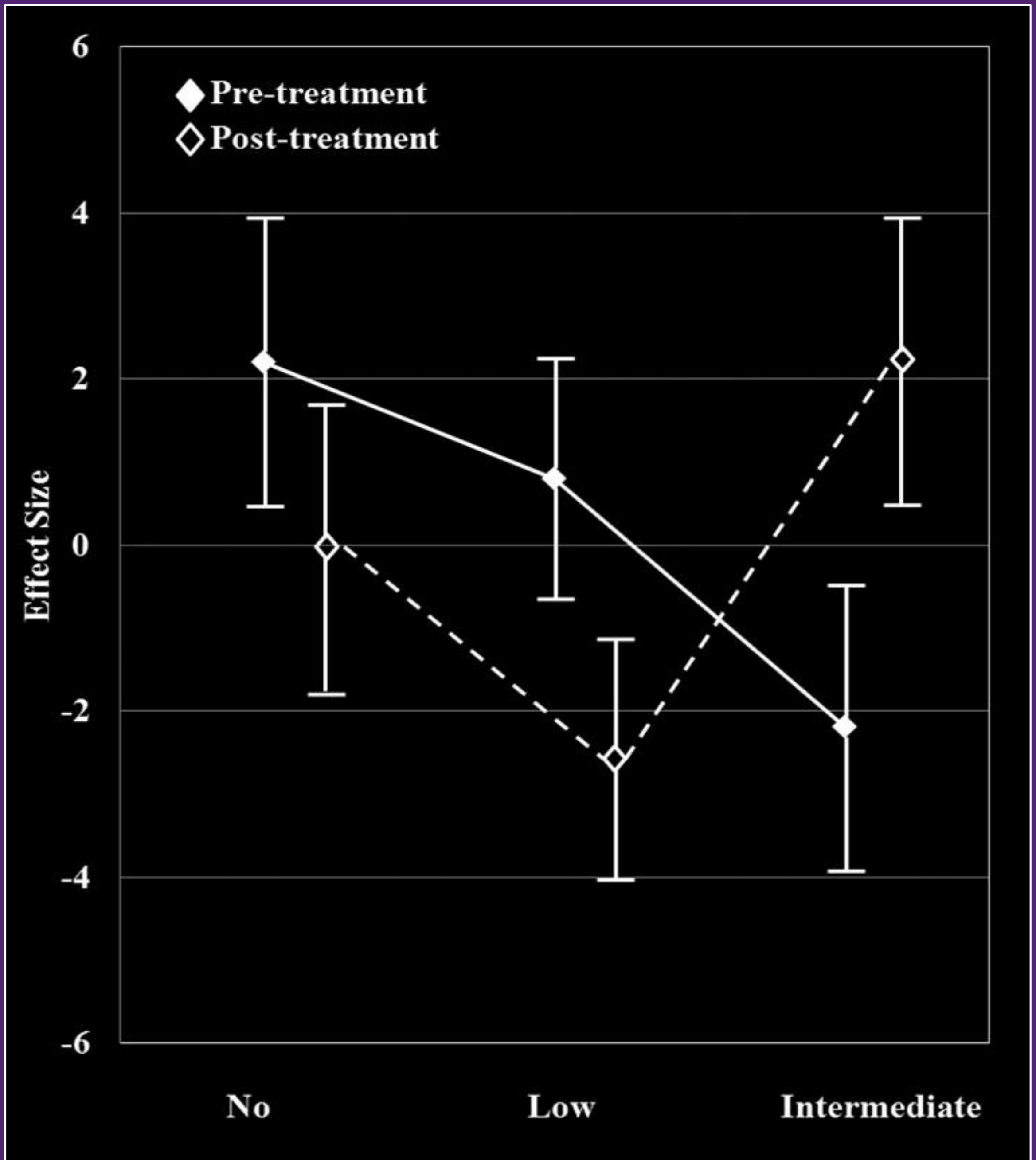
# Variation in Counts of Giant Salamanders



# Variation in Counts of Cascade Torrent Salamanders

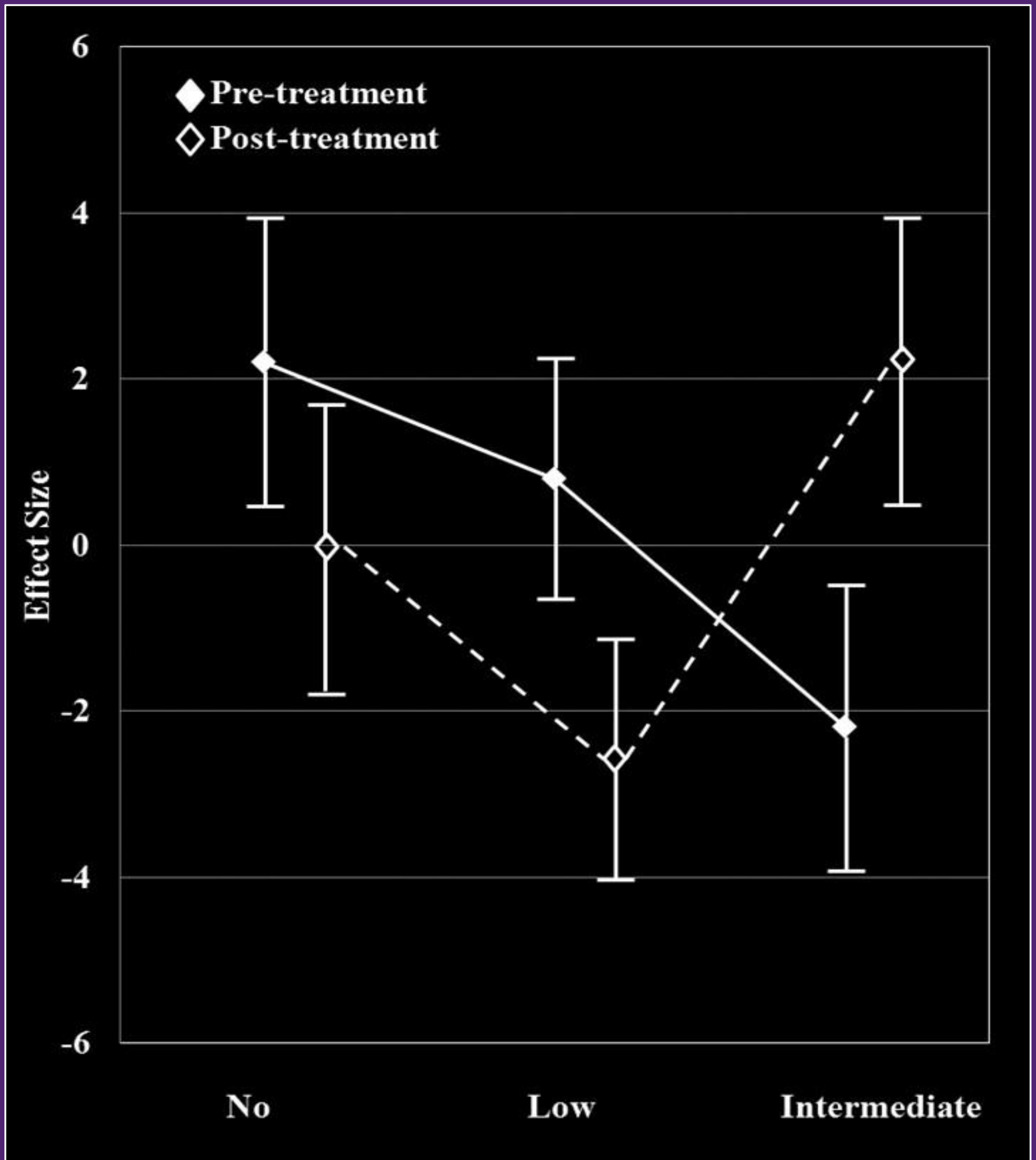


# Variation in Counts of Olympic Torrent Salamanders

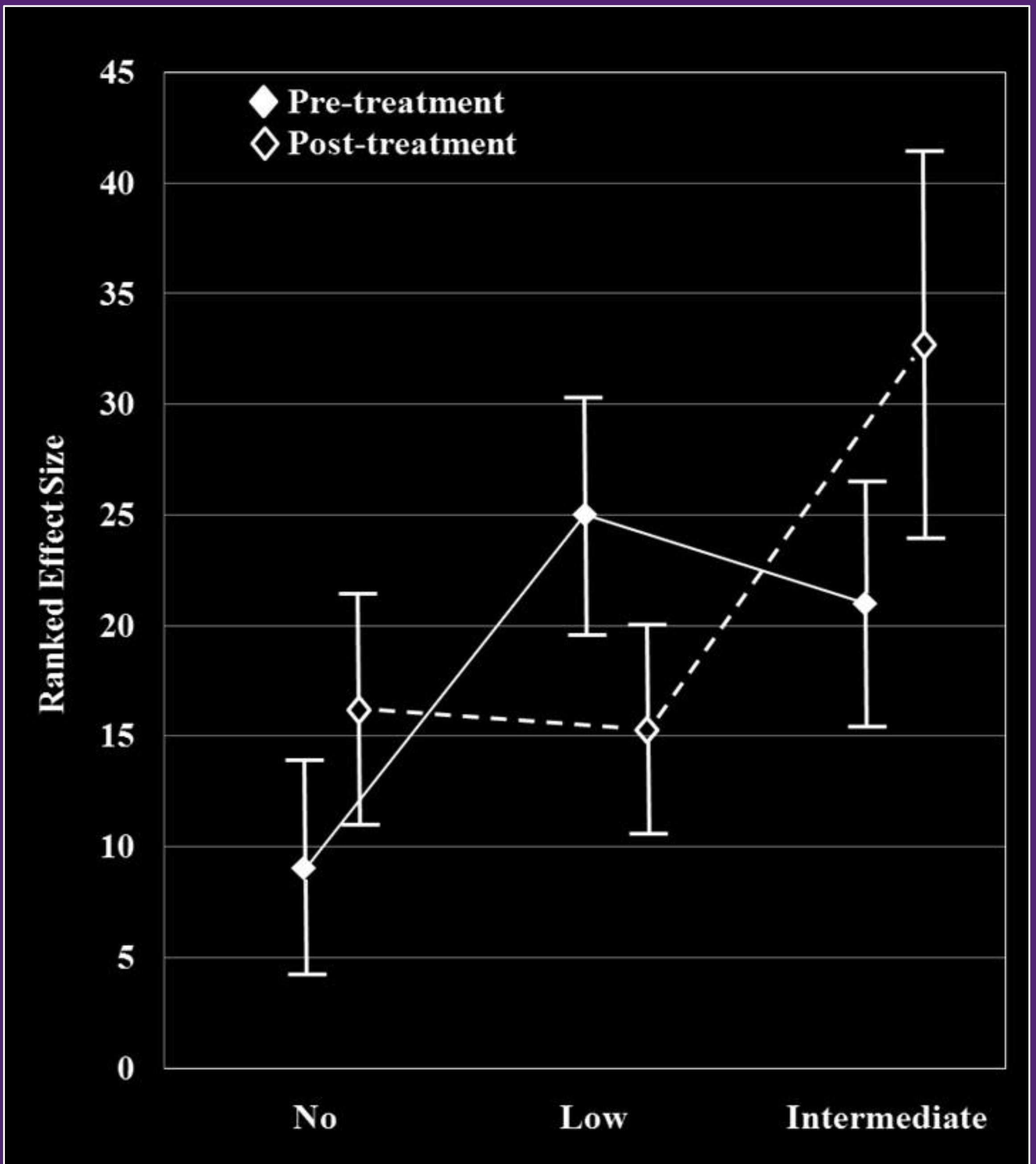




# Variation in Body Condition of Coastal Tailed Frog Larvae



# Variation in Body Condition of Cascade Torrent Salamanders



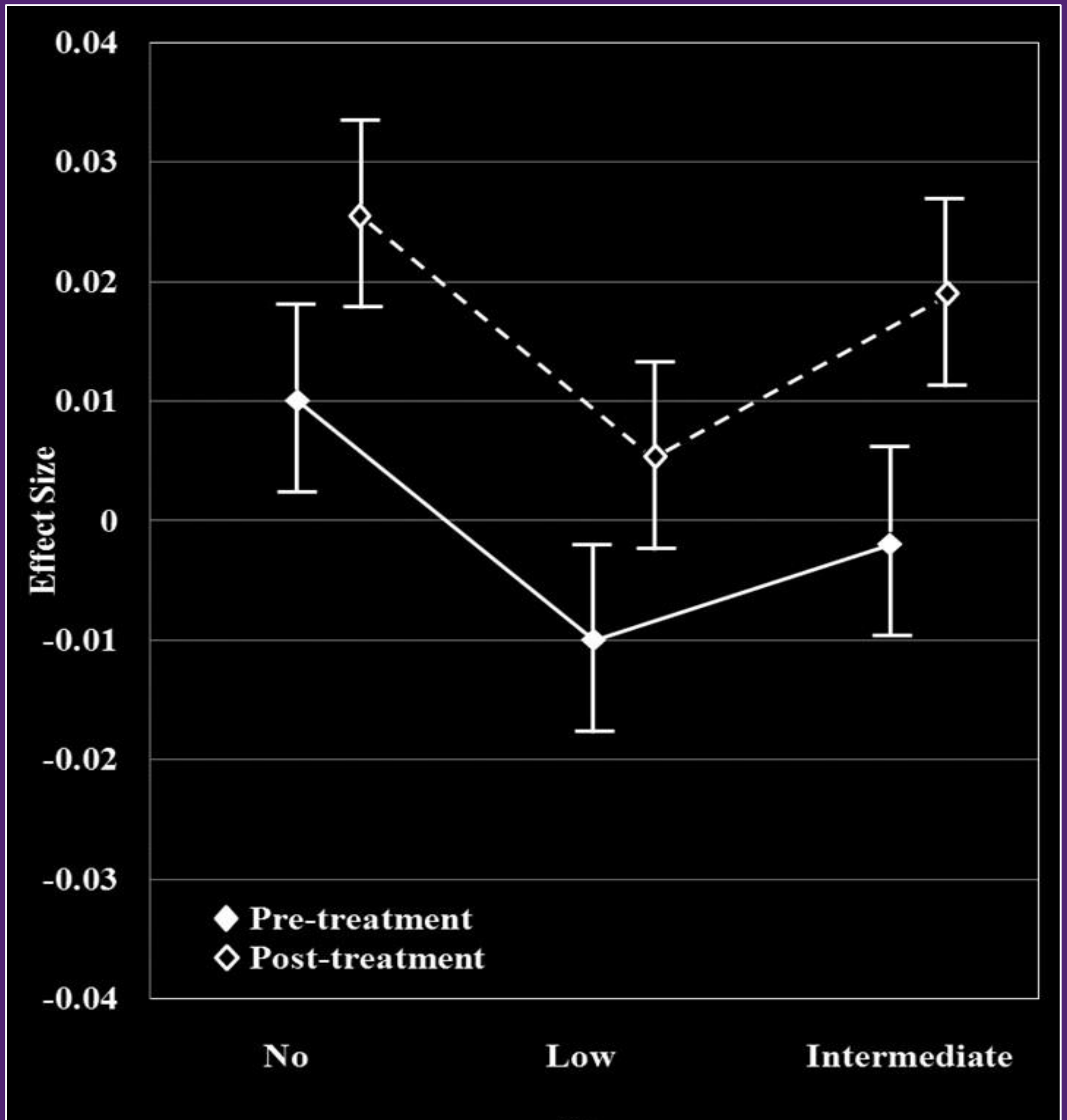


# Enclosures: Evaluating Growth



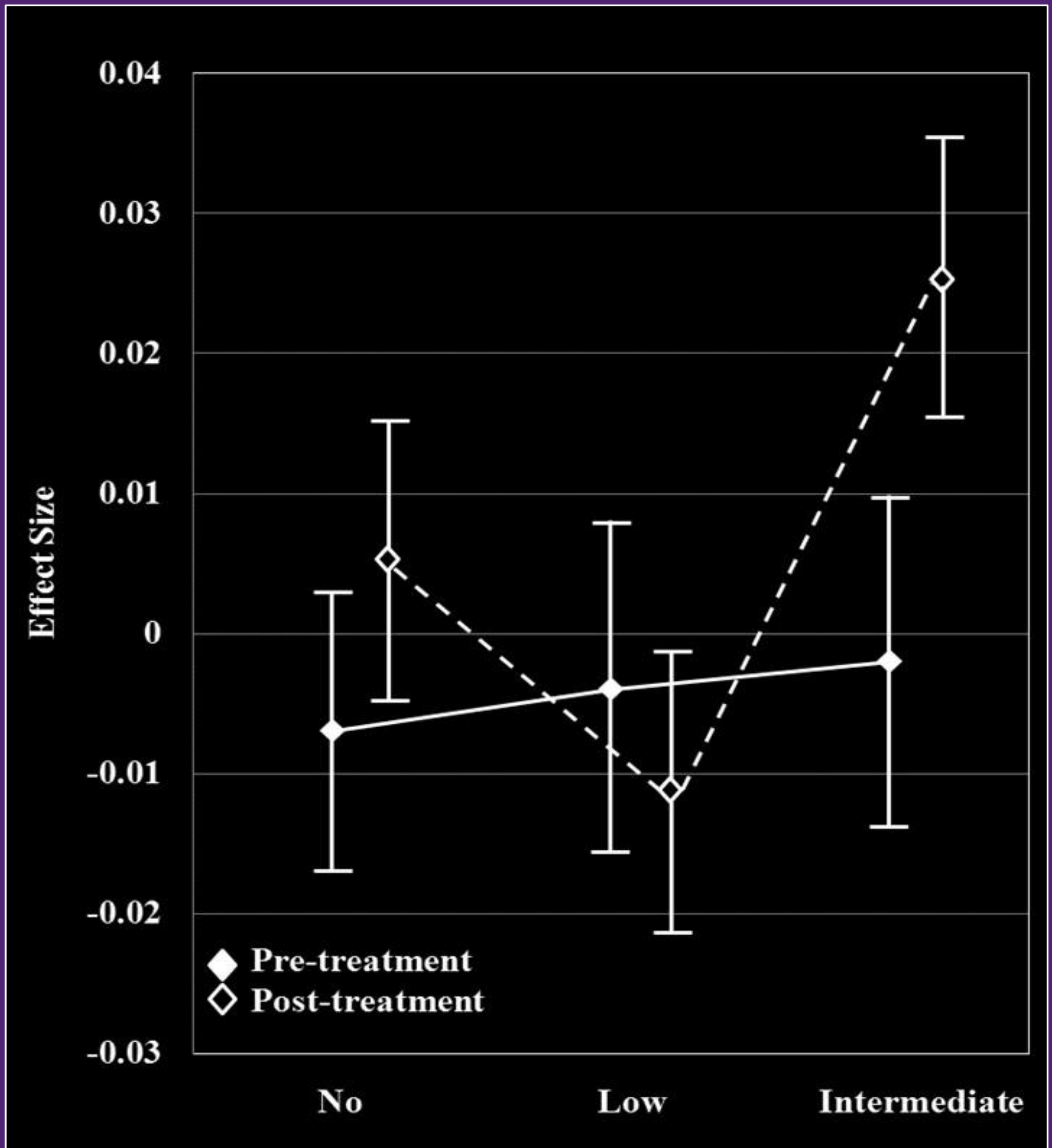


# Variation in Growth Rate of Coastal Tailed Frog Larvae

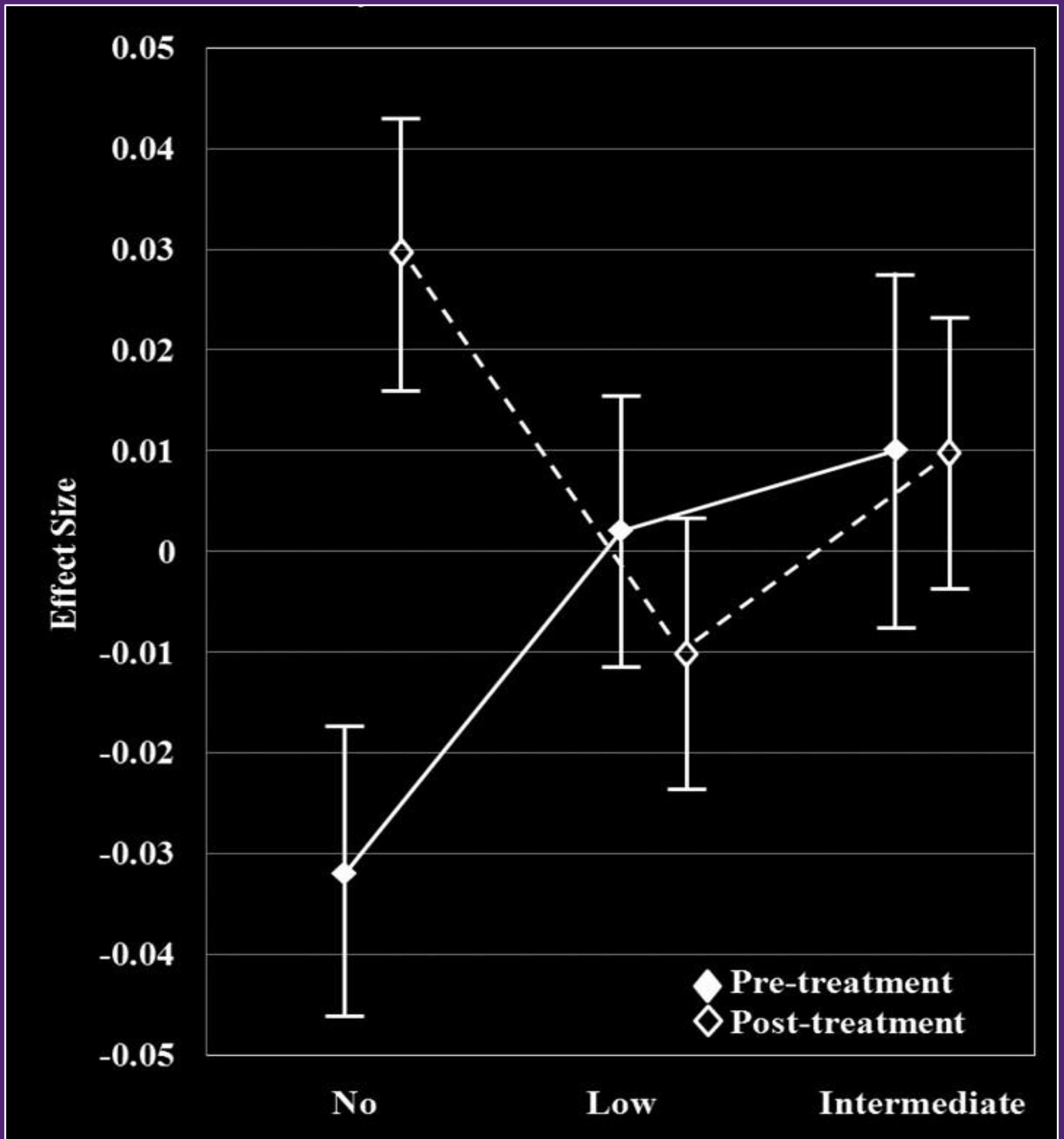




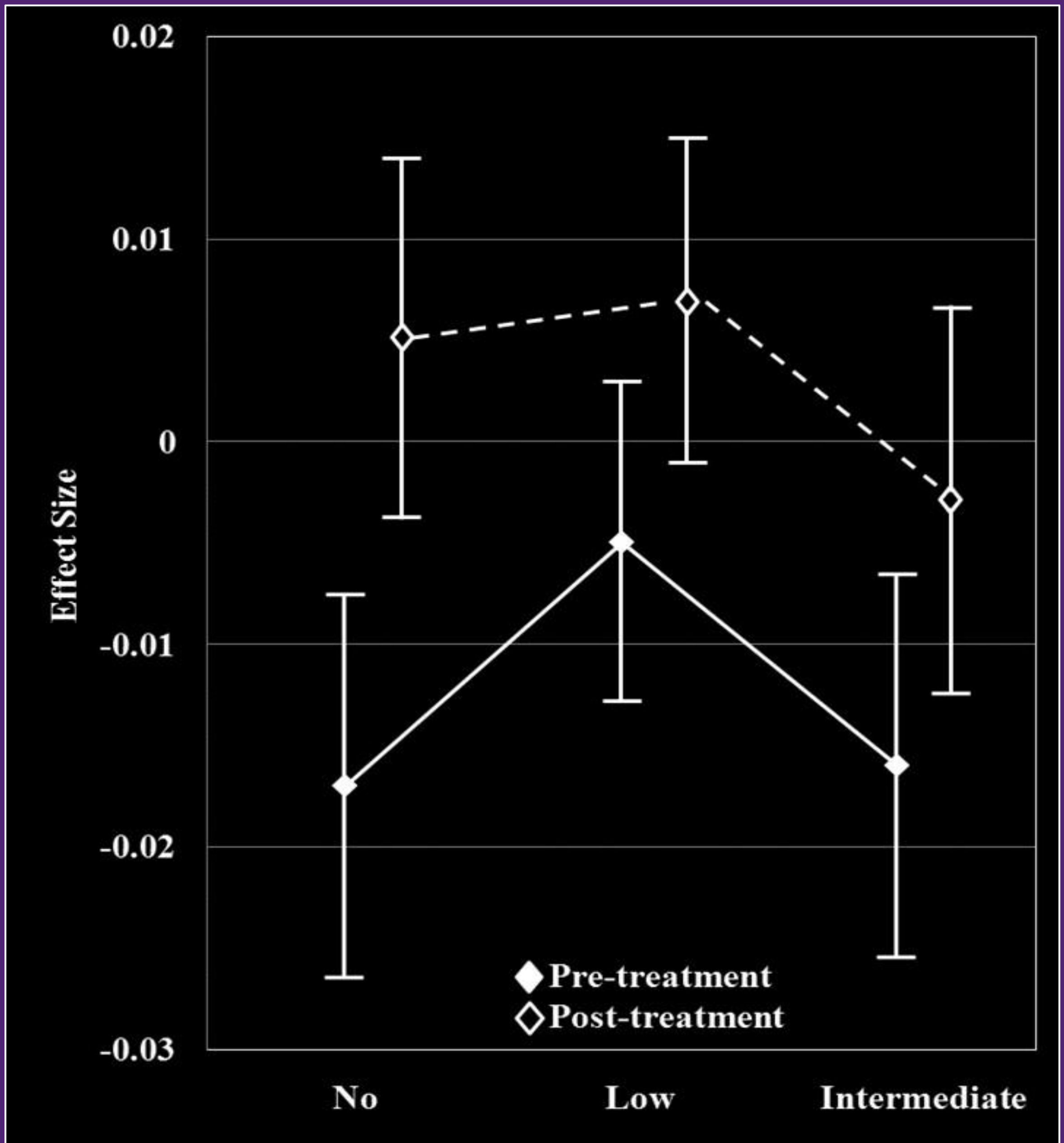
# Variation in Growth Rate of Cascade Torrent Salamander Larvae



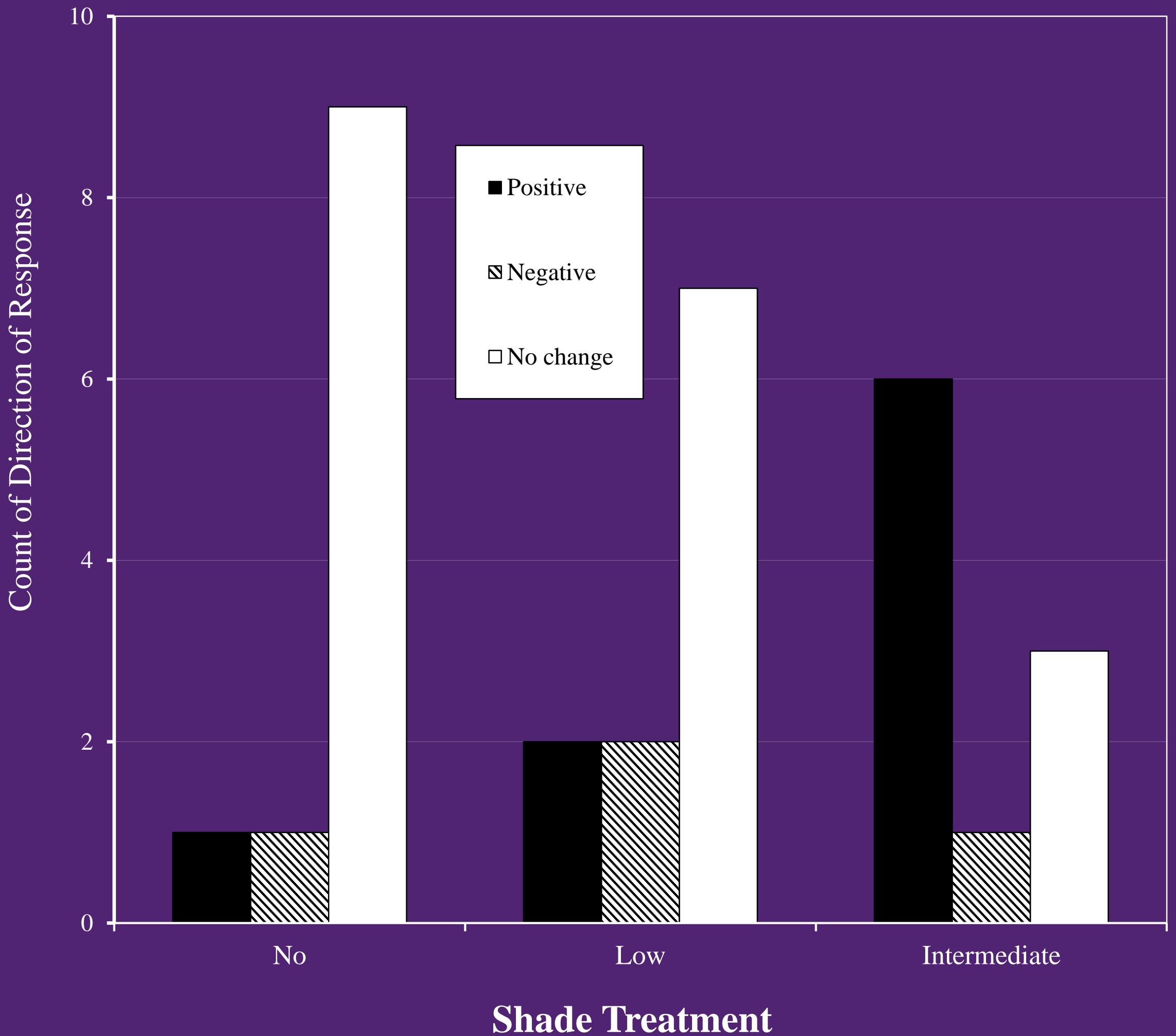
# Variation in Growth Rate of Columbia Torrent Salamander Larvae



# Variation in Growth Rate of Olympic Torrent Salamander Larvae

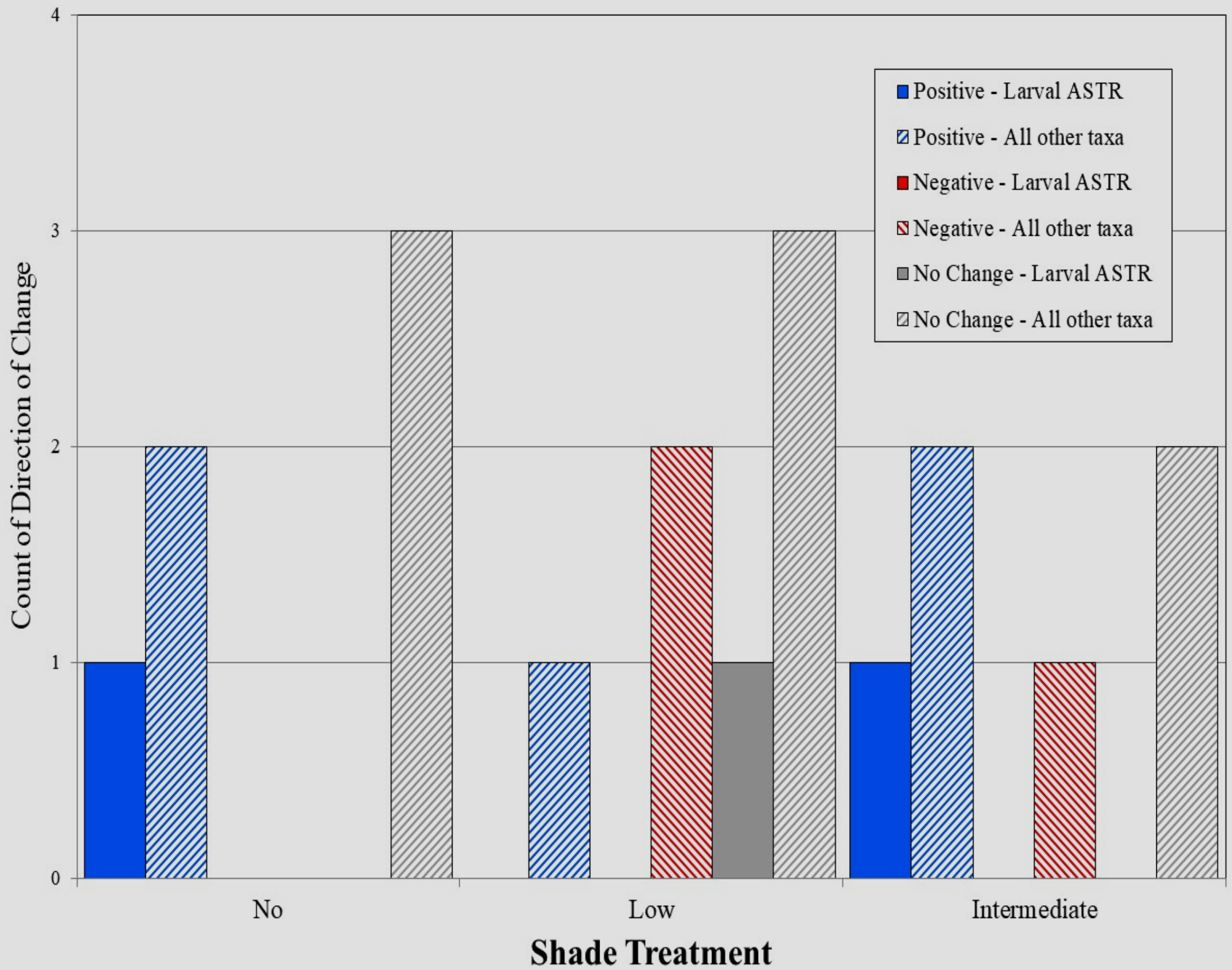


# Amphibian Count & Body Condition Response Summary





# Amphibian Growth Response Summary



# Highlights

- We achieved a shade reduction gradient.
- That gradient translated strongly to a light gradient.
- The shade reduction gradient also translated to increases in temperature...but the increases were only clear in the two treatments with the most reduced shade.
- The light gradient also translated to a biofilm production gradient.
- The shade reduction gradient also translated to declines in Coarse and Fine Particulate Organic Matter, but only in the most severe shade reduction treatment.
- Several changes in macroinvertebrate production seemed to track aforementioned shade reduction gradient-induced changes.
- Some stream-associated amphibian responses are also consistent with expectations linked to shade reduction gradient-induced changes.
- Considering amphibians collectively, we saw more positive and fewer negative responses in the Intermediate Shade treatment than in either the No or Low Shade treatments.
- Selected changes or lack thereof among macroinvertebrates and SAAs lack a clear explanation directly linked to shade reduction.
- We designed this field experiment to distinguish among levels of shade reduction, not identify the precise basis of the responses.