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The effects of visual and acoustic deterrents to prevent the upstream movement of Asian carps

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THE EFFECTS OF VISUAL AND ACOUSTIC DETERRENTS TO PREVENT THE UPSTREAM MOVEMENT OF ASIAN CARPS

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Introduction

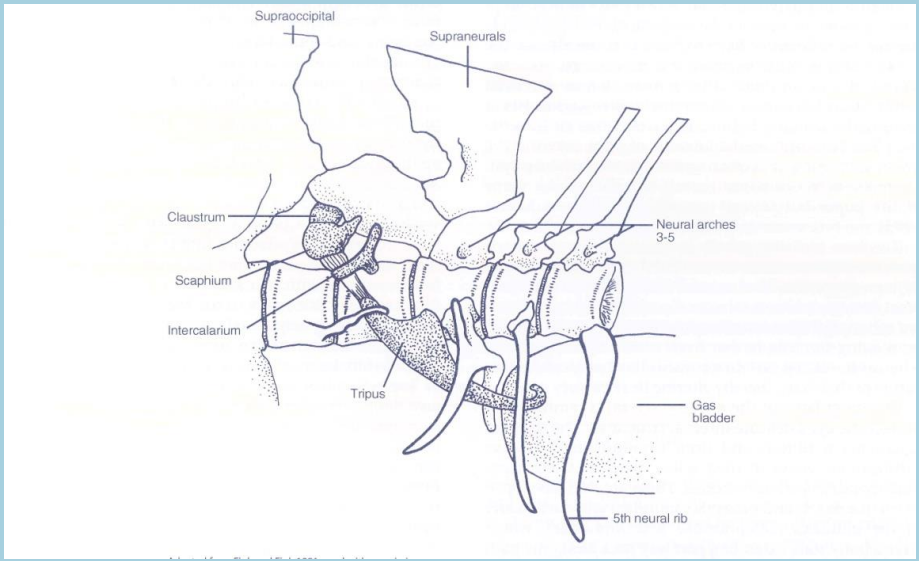
- Bighead and silver carp (hereafter Asian carp) introduced in early 1970s for aquaculture and polyculture (Arkansas and Illinois)
- Planktivorous, highly fecund, rapid growth rates, federally injurious species
- Wild populations established in Mississippi River Basin
- Upstream spawning movements
- Threat to the Great Lakes and Upper Mississippi River Basin
- CSSC Aquatic Nuisance Species Dispersal Barrier

Introduction

- eDNA detected upstream of CSSC Aquatic Nuisance Species Dispersal Barrier
- eDNA detected in Calumet Harbor, with physical collection of one BHCP in June, 2010
- Wisconsin River (Prairie du Sac), Lock and Dam #1 (MS River)
- Sound-bubble-strobe light barrier technologies as a potential deterrent system

Introduction

- Asian carp have a Weberian apparatus (Helfman et al. 1997)



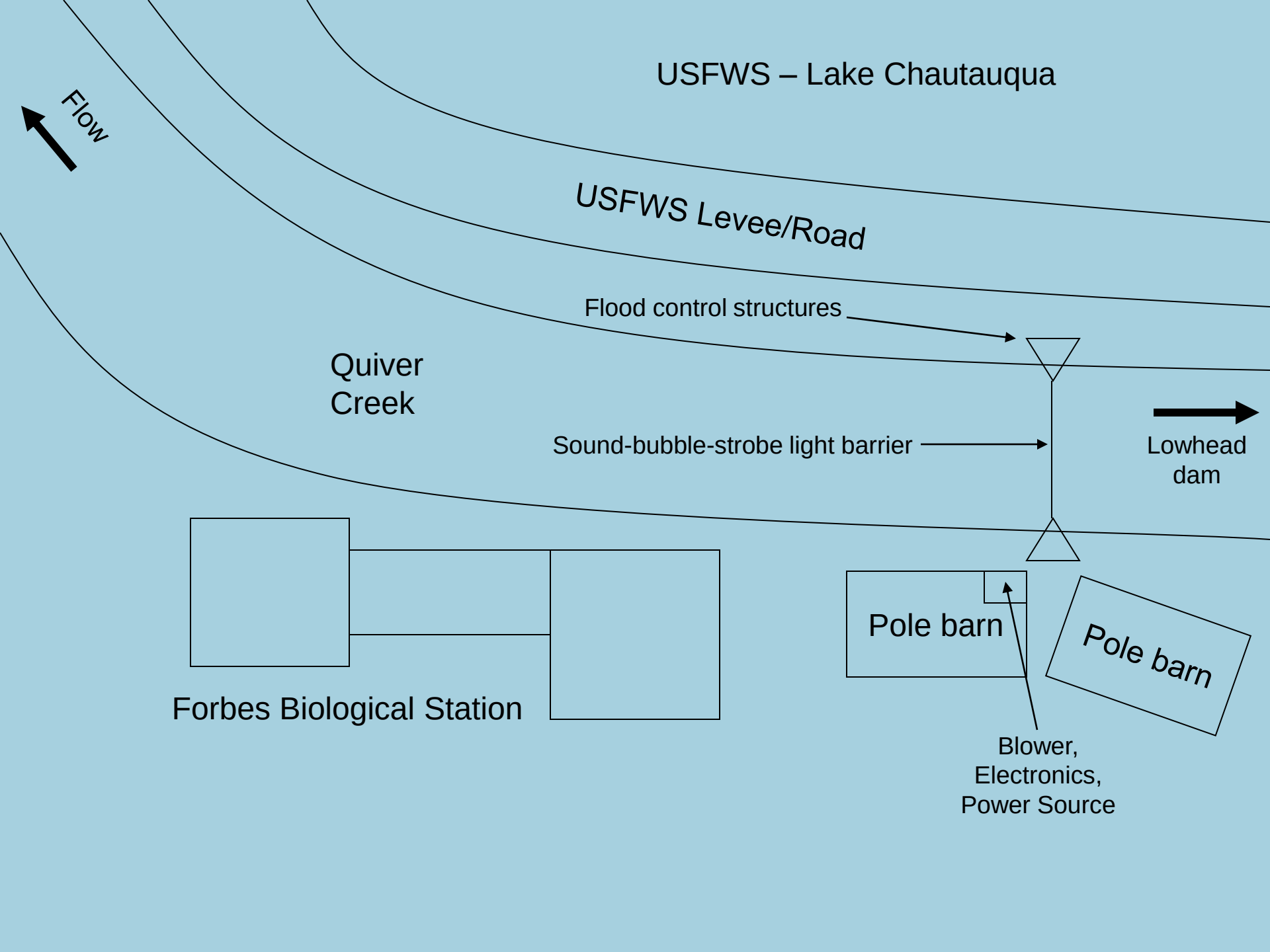
- Sound-bubble barrier technologies were shown to be 95% effective at deterring adult bighead carp passage in hatchery raceways (Taylor et al. 2005)

- Bighead and silver carp are sensitive to high sound frequencies, in the range of 750-1500 Hz (Lovell et al. 2006)

Objectives

- Test the effectiveness of sound-bubble-strobe light barrier technologies (SBSLB) for deterring upstream passage of Asian carp and non-Asian carp species at an ecosystem scale relevant for management
- Provide recommendations on whether these technologies could be used in other areas where Asian carp pose a threat (e.g. CSSC, Lock and Dam #1)

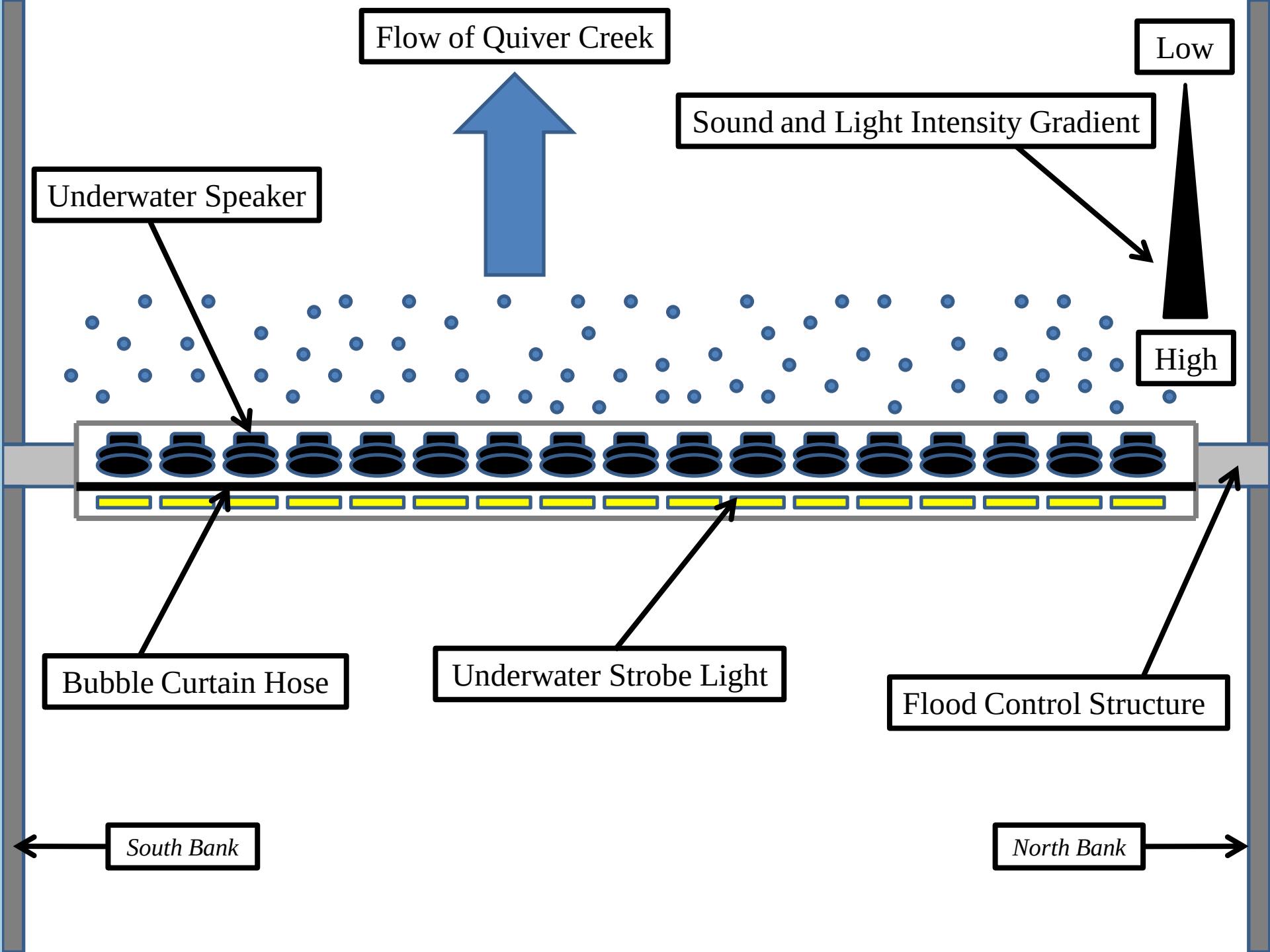

US FWS
Quiver Creek
Forbes Biological Station
Illinois River
Quiver Lake
Havana, IL
Image USDA Farm Service Agency
©2009 Google
Imagery Date: Jun 3, 2006
40°20'55.61" N 90°01'15.73" W elev 140 m
Eye alt 5.64 km


USFWS – Lake Chautauqua
Flow
USFWS Levee/Road
Flood control structures
Quiver
Creek
Sound-bubble-strobe light barrier
Lowhead
dam
Pole barn
Pole barn
Forbes Biological Station
Blower,
Electronics,
Power Source

SBSLB Components

- 16m SBSLB
- 16m air curtain hose
- 16 strobe lights
- 16 underwater speakers
- Speakers emit sound frequencies between 500-2000 Hertz





Flow of Quiver Creek
Low
Sound and Light Intensity Gradient
Underwater Speaker
High
Bubble Curtain Hose
Underwater Strobe Light
Flood Control Structure
South Bank
North Bank

SBSLB Operating

Photo Credit: Michelle Horath, INHS

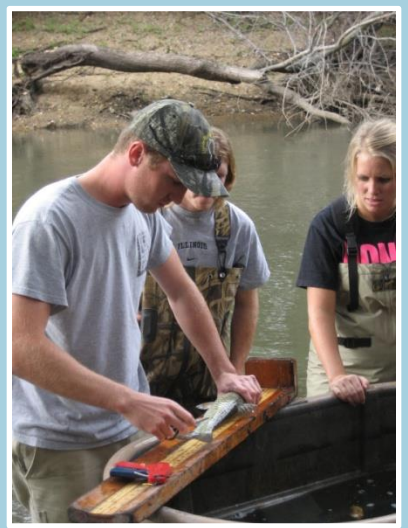
SBSLB Operating

Methods

- Asian carp and non-Asian carp species were captured from the main-stem Illinois River and Quiver Creek, respectively, by pulsed-DC boat electrofishing, back-pack electrofishing, hoop nets, and angling

Methods

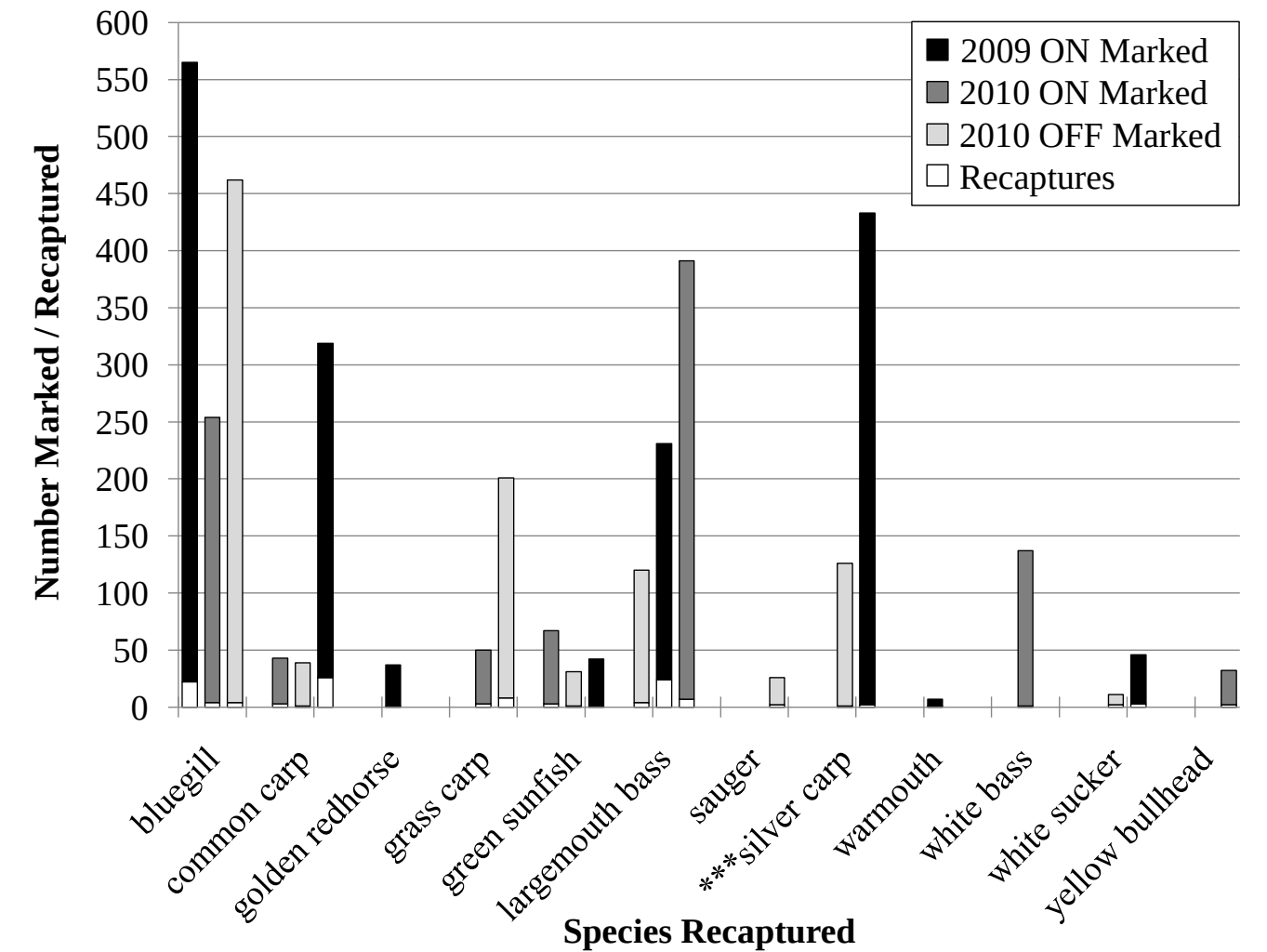
- All captured fish were measured for length and weight, floy-tagged and fin clipped, and then released directly below the SBSLB in Quiver Creek
- SBSLB effectiveness was determined by upstream recaptures of marked fishes
- Recaptures were collected between the SBSLB and the upstream low-head dam using back-pack electrofishing, hoop netting, and angling



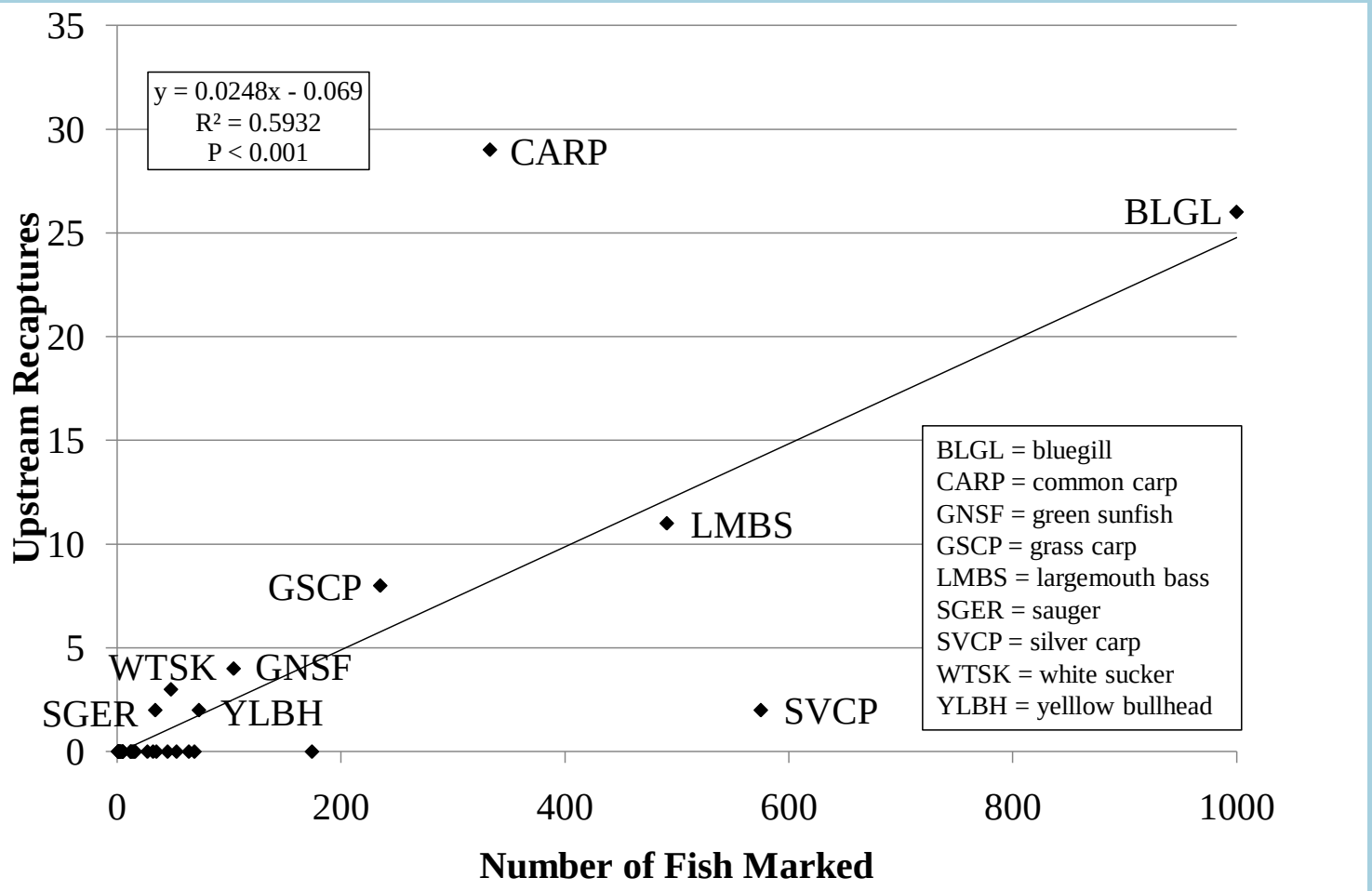
Results

- Trials were conducted from August 26 - October 7, 2009 and August 27 – October 27, 2010
- 40 fish species captured and tagged
- 2,937 non-Asian carp were captured upstream of the barrier and released downstream of the SBSLB
- 85 non-Asian carp were recaptured upstream of the barrier (up to 97% effectiveness)
- 575 silver carp were transplanted from the main-stem Illinois River and released downstream of the SBSLB
- 2 silver carp were recaptured upstream of the barrier (up to 99% effectiveness)
- No marked bighead carp (n = 101) were recaptured upstream of the barrier

Percentage of fishes recaptured by species during ON and OFF sound-bubble-strobe light barrier trials in Quiver Creek, Havana, Illinois, USA, 2009-2010. Please note that no bighead carp were recaptured.



The number of fish recaptured versus the number marked by species for all ON trials testing sound-bubble-strobe light barrier technology in Quiver Creek, Havana, Illinois, USA, 2009-2010. Please note that only recaptured species are labeled.



Conclusions

- Our results suggest that SBSLB technologies could be used as a deterrent system to repel Asian carp, but not as absolute barrier (up to 99% effectiveness)
- SBSLB technologies also repelled non-Asian carp species (up to 97% effectiveness)
- Blockage of native fish species upstream passage must also be considered when applying these technologies for Asian carp management

Acknowledgements

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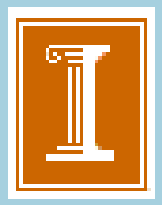
- Fish Guidance Systems Ltd. and Eimco Water Technologies



Questions?

Ruebush, B.C., G.G. Sass, J.H. Chick, and J.D. Stafford. 2012. *In-situ* tests of sound-bubble-strobe light barrier technologies to prevent range expansions of Asian carp. Aquatic Invasions 7(1):37-48.