



# Brown Trout at Lees Ferry, crisis or Red Herring?

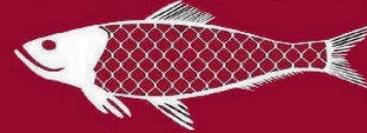
David Rogowski, Jan Boyer

Research Branch

Arizona Game and Fish Department

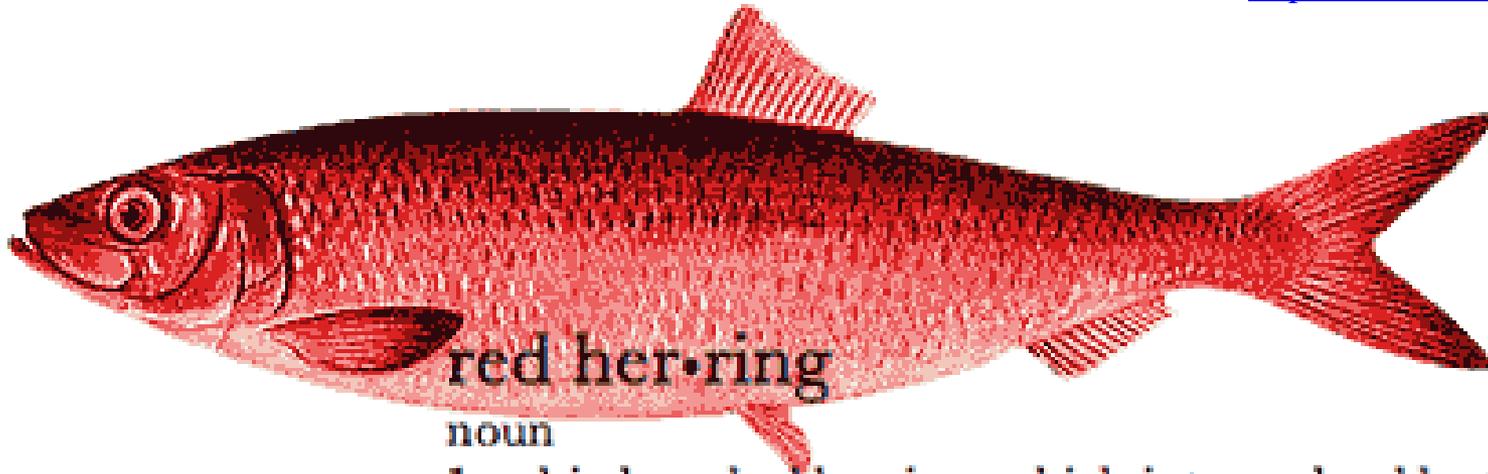
# Red herring

**RED HERRING ALERT**



**THERE'S SOMETHING FISHY GOING ON!**

<https://redherringalert.wordpress.com/>

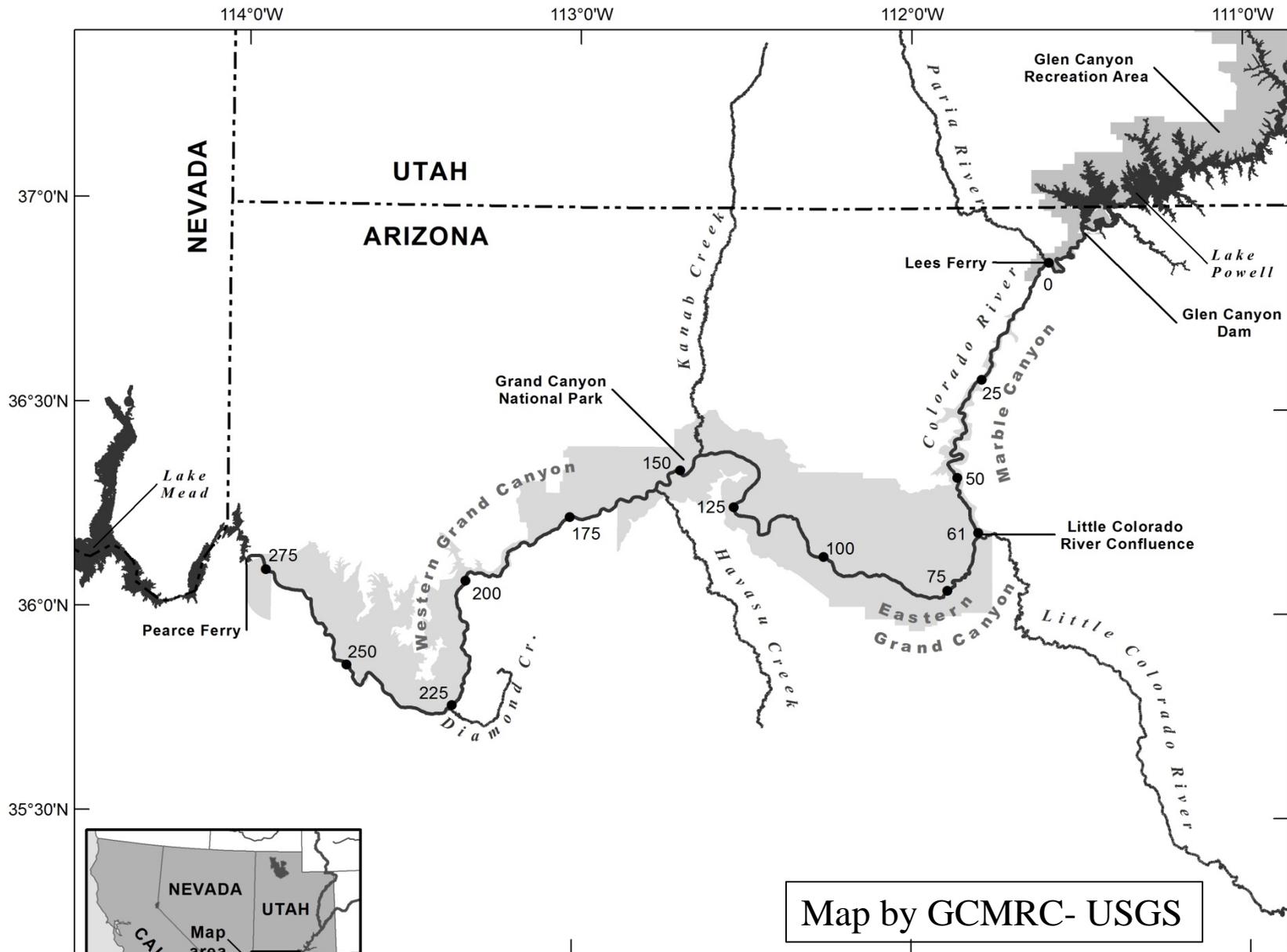


red her·ring

noun

- 1 a dried smoked herring, which is turned red by the smoke.
- 2 something, esp. a clue, that is or is intended to be misleading or distracting : *the book is fast-paced, exciting, and full of red herrings*. [ORIGIN: so named from the practice of using the scent of red herring in training hounds.]

[https://www.tes.com/lessons/jorwA1jii\\_5fnQ/red-herring](https://www.tes.com/lessons/jorwA1jii_5fnQ/red-herring)



# Lees Ferry

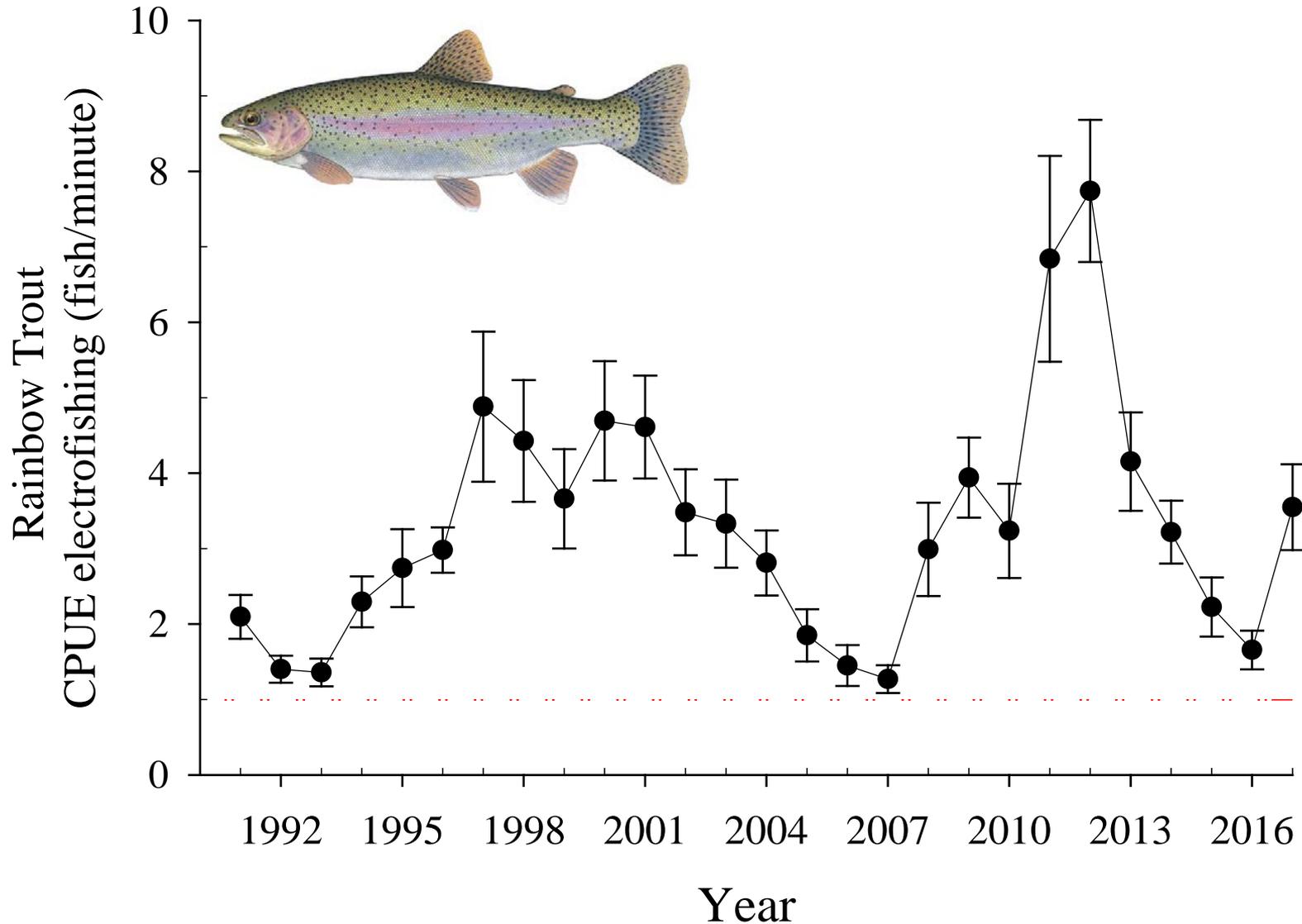
- Predominately a Rainbow Trout fishery



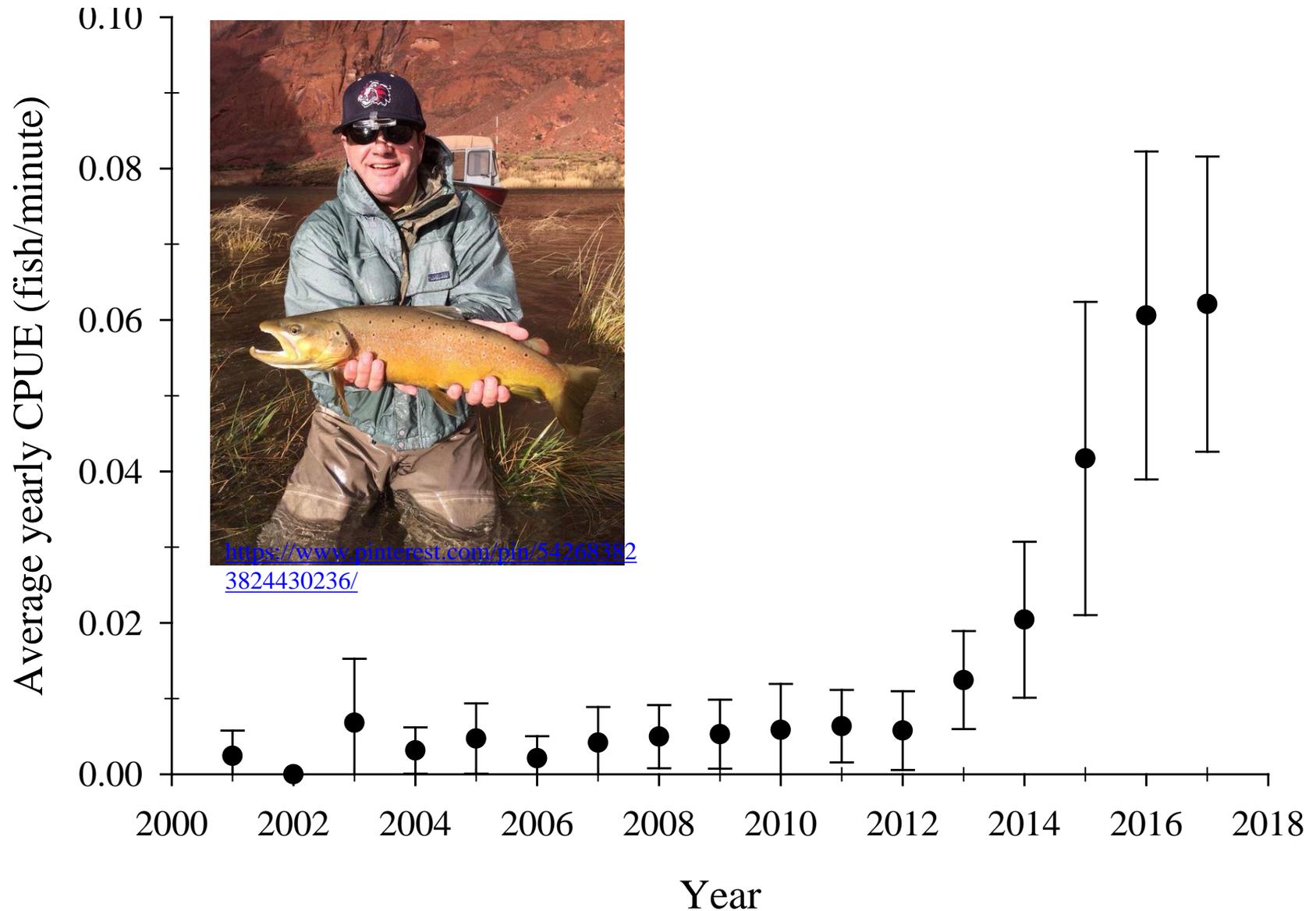
Photo: George Andrejko

# Rainbow Trout CPUE electrofishing

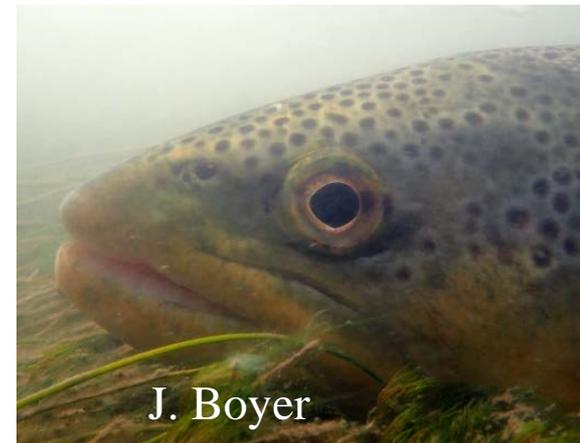
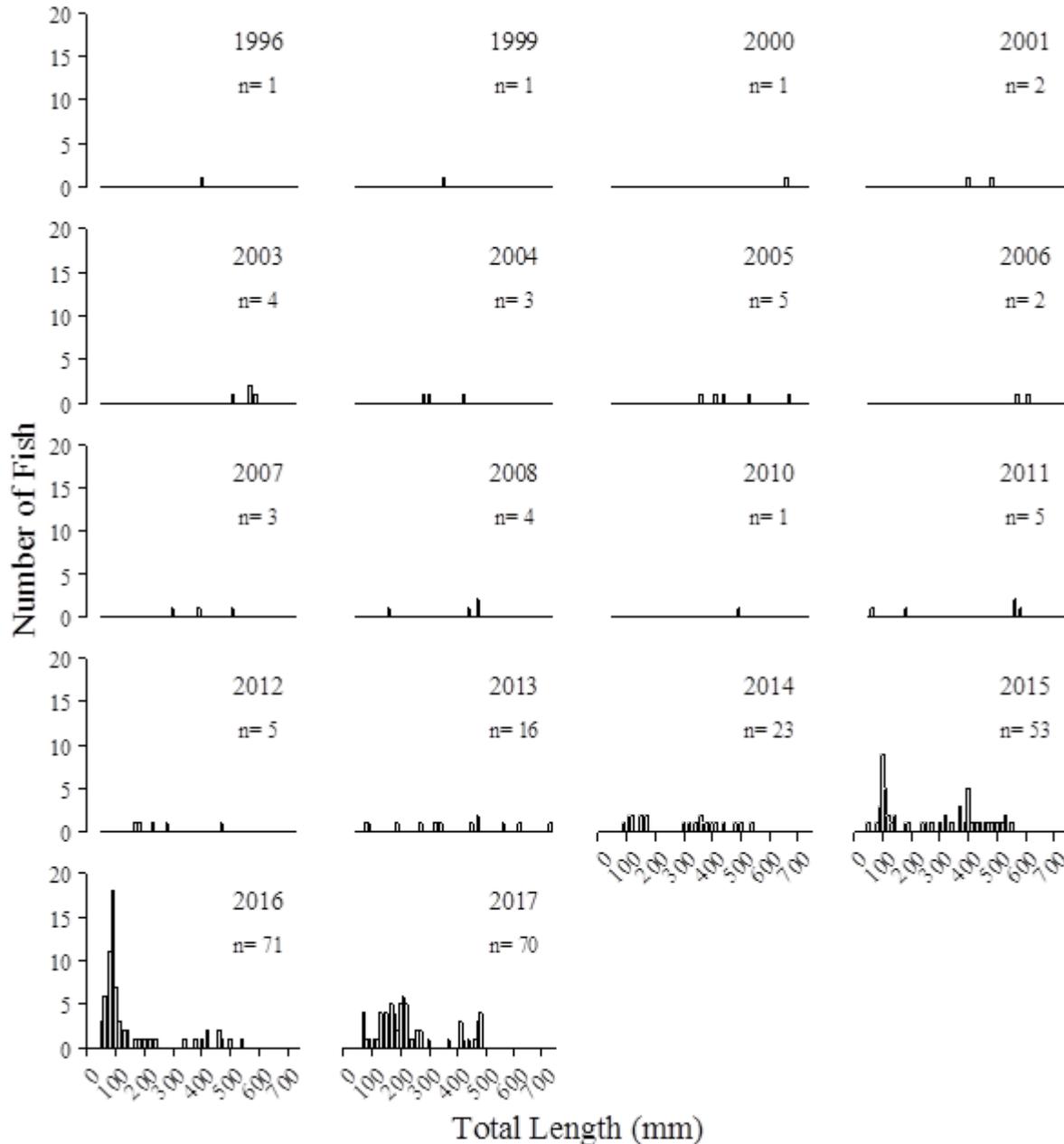
RBT= 97.7 % of catch in 2017



# Brown Trout average electrofishing CPUE (fish/minute)



# Brown Trout length frequency histograms



# Brown Trout below Glen Canyon Dam: A Preliminary Analysis of Risks and Options

## Workshop Planning Team:

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Chris Cantrell, Arizona Game and Fish Department  
Shane Capron and Craig Ellsworth, Western Area Power Administration  
Katrina Grantz and Marianne Crawford, Bureau of Reclamation  
Jessica Gwinn, U.S. Fish and Wildlife Service  
Scott VanderKooi, U.S. Geological Survey  
Mike Runge, U.S. Geological Survey  
David Braun, GCDAMP Science Advisors Program

Final Pre-Workshop Version  
September 21, 2017

Glen Canyon National Recreation Area  
Grand Canyon National Park  
Arizona

National Park Service  
U.S. Department of the Interior



## Expanded Non-native Aquatic Species Management Plan in Glen Canyon National Recreation Area and Grand Canyon National Park below Glen Canyon Dam—An Environmental Assessment



### You're Invited!

The National Park Service (NPS) requests your input on an Environmental Assessment (EA) for an Expanded Non-native Aquatic Species Management Plan in Grand Canyon National Park and Glen Canyon National Recreation Area below Glen Canyon Dam. Your participation is vital to the planning process. There are many ways to be involved, including attending one of the public scoping open houses or on-line webinars. You can submit electronic or written comments (see last page for more information). Public scoping will be held for a 30-day period from November 15, 2017 to December 14, 2017.

### Public Meetings and Webinars

Scoping provides opportunities for the public to engage on matters related to the proposed action, environmental issues that should be addressed, potential alternatives, and sources of data that should be considered. Because the EA will analyze many ecological, recreational and economic issues, your participation is encouraged and needed. NPS will hold one online webinar and two in-person meetings. During the online webinar, our staff will be available to answer questions, but we will not record or accept verbal or chatted comments. The in-person meetings will follow an open house format and will include a presentation by our staff. There will be an opportunity to speak with our staff after the presentation. We will not record or accept verbal comments however we will have laptops for entering electronic comments or notecards for hand-written comments.

#### November 28, 2017

6:00-8:00 pm MST  
Public Webinar  
Phone: 888-946-2716  
Passcode: 5935870  
<https://bluejeans.com/7293338944>

Join as guest (enter name)

Select "screen share only" at bottom  
DO NOT choose "computer" or "phone"

#### December 6, 2017

6:00-8:30 pm MST  
Public Open House  
Glen Canyon Headquarters  
691 Scenic View Drive  
Page, AZ 86040

#### December 7, 2017

6:00-8:30 pm MST  
Public Open House  
Flagstaff Aquaplex  
1702 N Fourth Street  
Flagstaff, AZ 86004

# Why the increase?

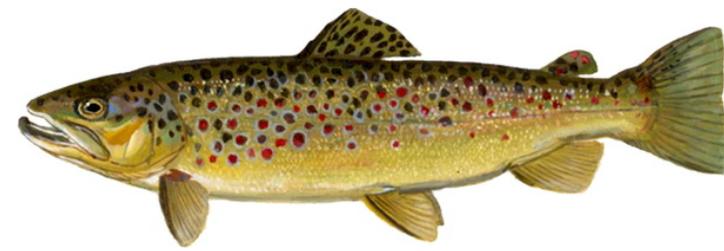


- Reduced Rainbow Trout density
  - Less interference spawning (Scott & Irvine 2000)
  - Less competition with YOY and juveniles
- Fall high flow events (2012-2014, and 2016)
  - Cleans/scours gravel for spawning
  - Cue for migration



# Why the increase?

- Brown Trout removal program at Bright Angel Creek (2011-2017)
  - Strong selection against using Bright Angel Creek
  - Fish now moving upstream?



# Why the increase?

- Recent warm water temperatures are facilitating increased growth and survival
- Increase associated with whirling disease in Rainbow Trout
- Current prey base improves recruitment and growth of Brown Trout
- Abundant rainbow trout prey



# Brown Trout, are they a problem?

Major concerns are:

1. Change to a Brown Trout fishery
2. Move downstream and impact endangered fish (Humpback Chub)



# Switch to Brown Trout fishery?

- Population of Brown Trout continues to increase
- Brown Trout and Rainbow Trout co-occur throughout the world
  - San Juan River, NM
  - Green River (Flaming Gorge), UT
  - Madison River, WY/MT
- Limited evidence that this occurs



By Jan Boyer

# One exception

- Hasegawa, K. 2014. Replacement of nonnative rainbow trout by nonnative brown trout in the Chitose River system, Hokkaido, northern Japan. *Aquatic Invasions* 9(2):221–226.



Research Article

## Replacement of nonnative rainbow trout by nonnative brown trout in the Chitose River system, Hokkaido, northern Japan

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Handling editor: Vadim Panov

### Abstract

In this study, evidence for interspecific interaction was provided by comparing distribution patterns of nonnative rainbow trout *Oncorhynchus mykiss* and brown trout *Salmo trutta* between the past and present in the Chitose River system, Hokkaido, northern Japan. *O. mykiss* was first introduced in 1920 in the Chitose River system and has since successfully established a population. Subsequently, another nonnative salmonid species, *S. trutta* have expanded the Chitose River system since the early 1980s. At present, *S. trutta* have replaced *O. mykiss* in the majority of the Chitose River, although *O. mykiss* have persisted in areas above migration barriers that prevent *S. trutta* expansion. In conclusion, the results of this study highlight the role of interspecific interactions between sympatric nonnative species on the establishment and persistence of populations of nonnative species.

**Key words:** biological invasions, interspecific interaction, migration barrier, nonnative salmonids

### Introduction

Interspecific interactions between nonnative and native species play a key role in the decline of native species populations and the collapse of native ecosystems (Parker et al. 1999) and also the establishment and/or persistence of nonnative species (Southward et al. 1998; Melbourne et al. 2007). Since multiple nonnative species co-occur in many regions, interspecific interactions between nonnative species may also influence nonnative species (Ricciardi and MacIsaac 2011). For example, the invasional meltdown hypothesis, which proposes that nonnative species facilitate successful establishment of other nonnative species, is a commonly accepted theory among ecologists (Simberloff and Von Holle 1999). Moreover, species replacement is also likely to occur between the interacting nonnative species; this process has not been well evaluated to date.

A number of salmonid species have been introduced into many nonindigenous regions, and

have had devastating effects on native species (Fausch 1988; Townsend 1996). One of the most serious problems of the devastating effects is species replacement of native salmonids by nonnative salmonids (Fausch 1988). Several kind of interspecific interactions have been proposed as potential mechanisms of replacement such as competition, predation, hybridization and introduction of parasites and disease (Krueger and May 1991). Moreover, multiple nonnative salmonids co-occur in many regions (e.g. Houde et al. 2014; Kitano et al. 2014). Species replacement is also likely to occur between nonnative salmonid species, if they interact with one another. That is to say, interspecific interactions are closely related to the establishment and persistence of populations of each nonnative salmonid species.

In Hokkaido, northern Japan, nonnative rainbow trout, *Oncorhynchus mykiss* (Walbaum, 1792), and brown trout, *Salmo trutta* (Linnaeus, 1758), co-occur in some regions (Takami and Aoyama 1999). Both *O. mykiss* and *S. trutta* are listed

## Brown Trout, Chitose River

<https://pbs.twimg.com/media/Cdw2pVsVIAAdYdy.jpg>

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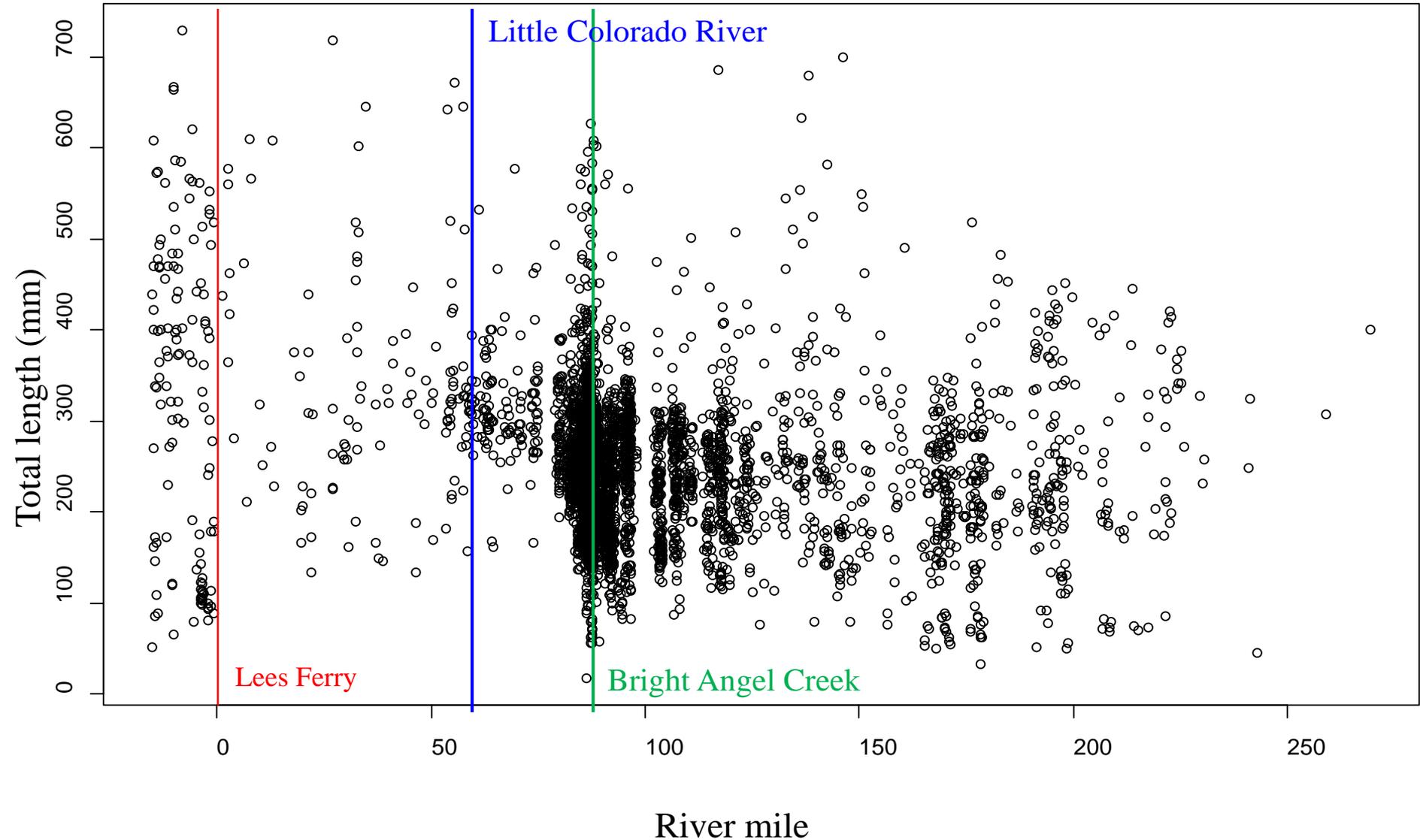


Illustration by Joseph R. Tomelleri

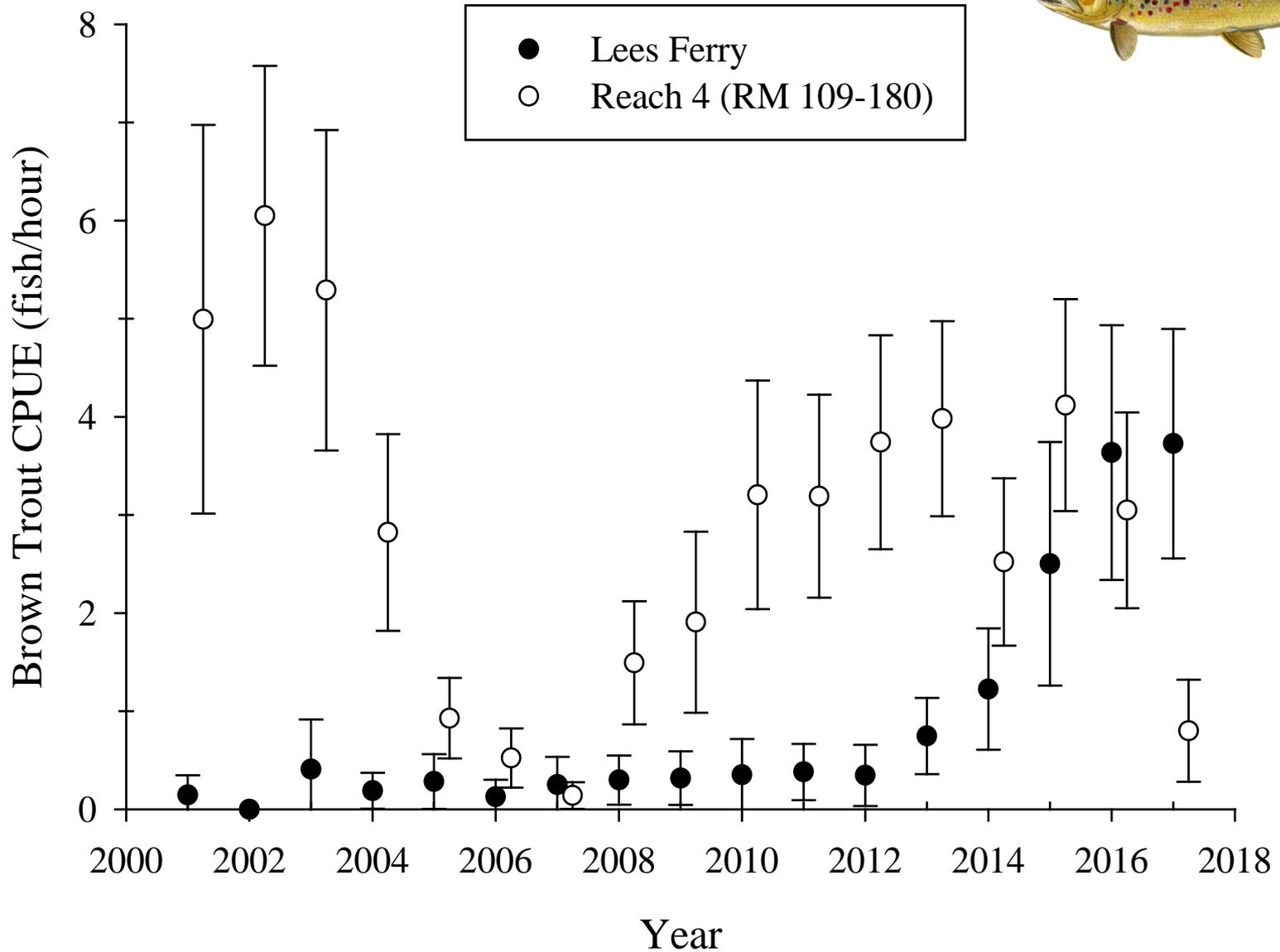


# Brown Trout in the Colorado River

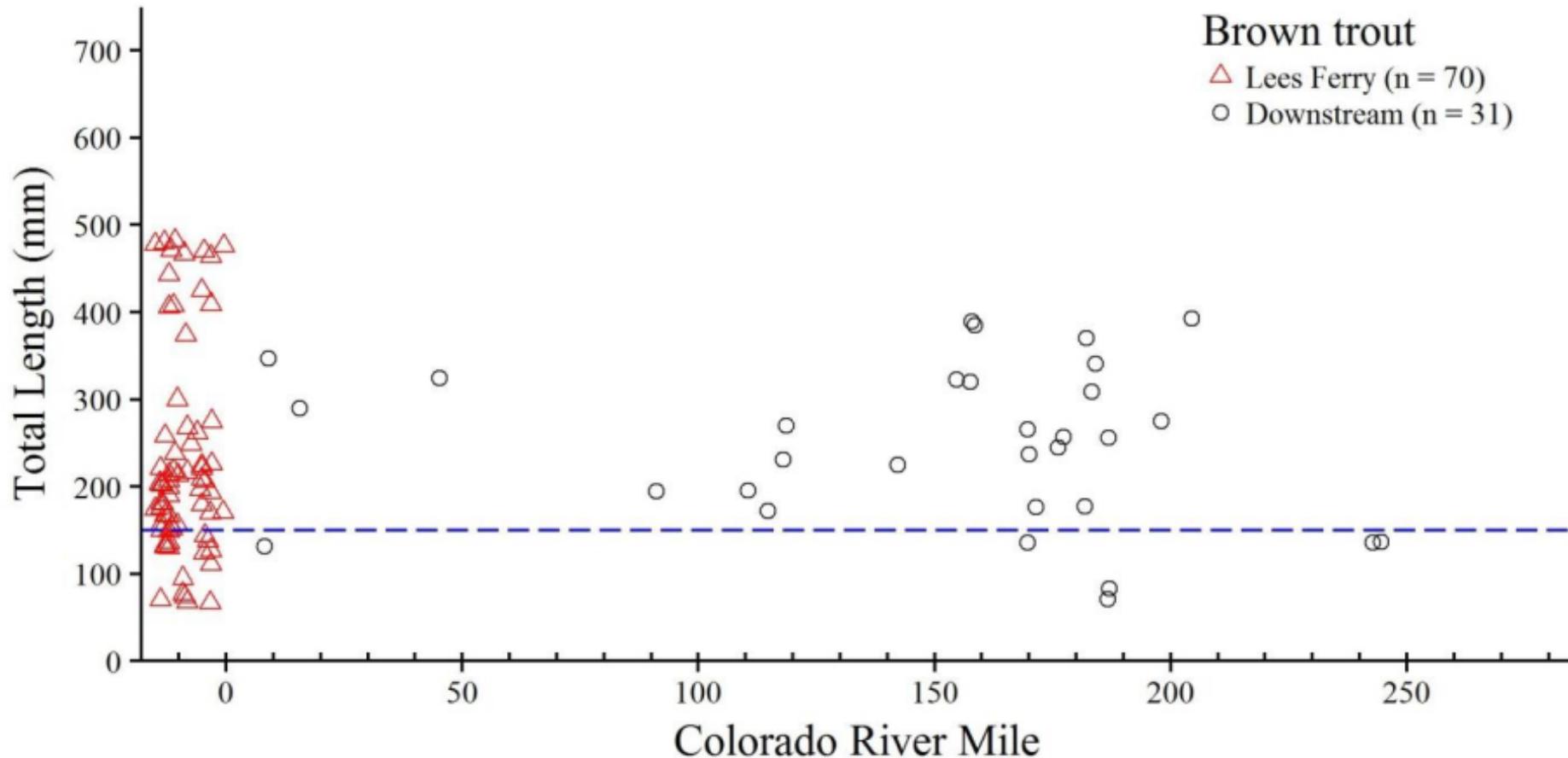
AGFD electrofishing data (1996-2016)



# Brown Trout avg. electrofishing CPUE (fish/hour)

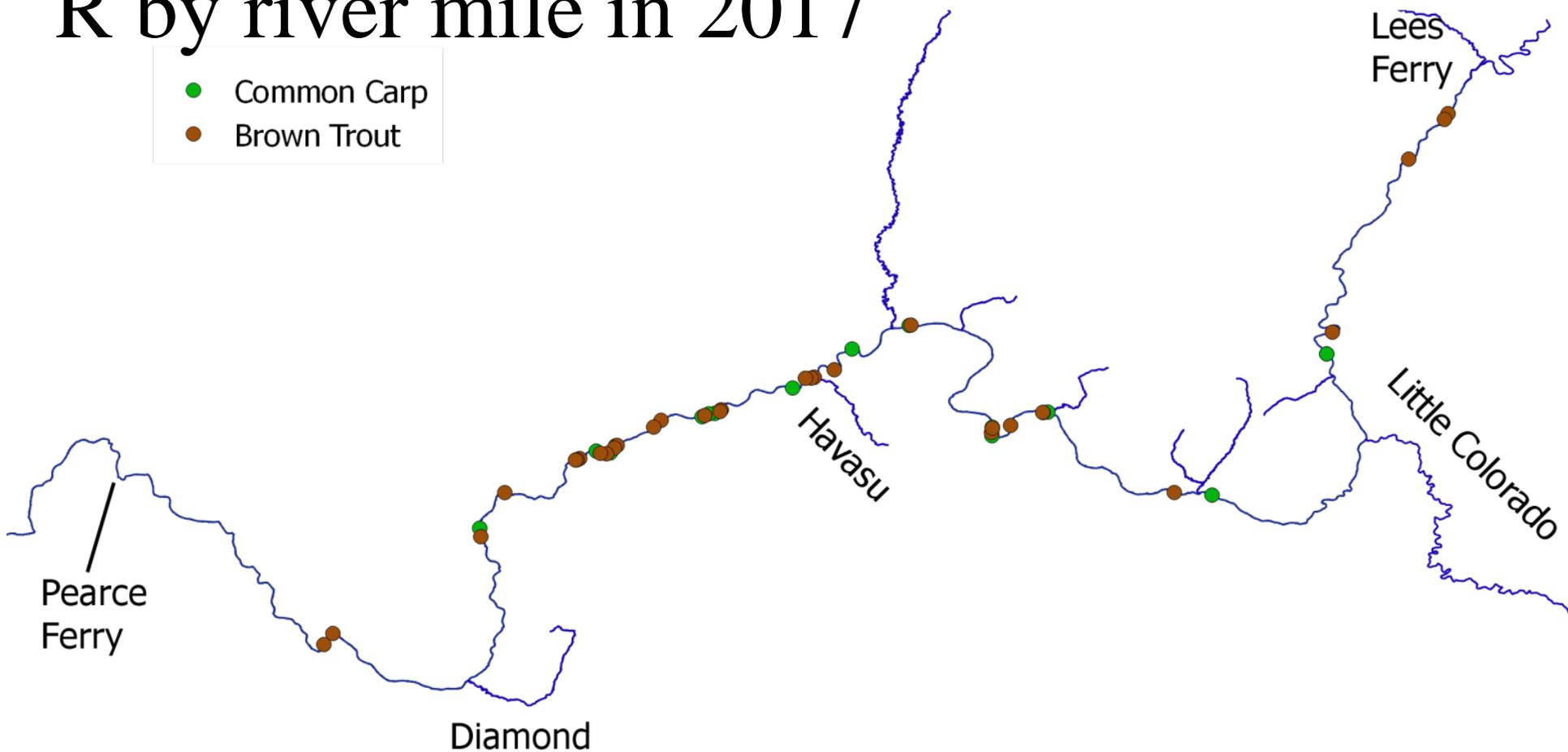


# Total length of all Brown Trout captured in the Co R by river mile in 2017

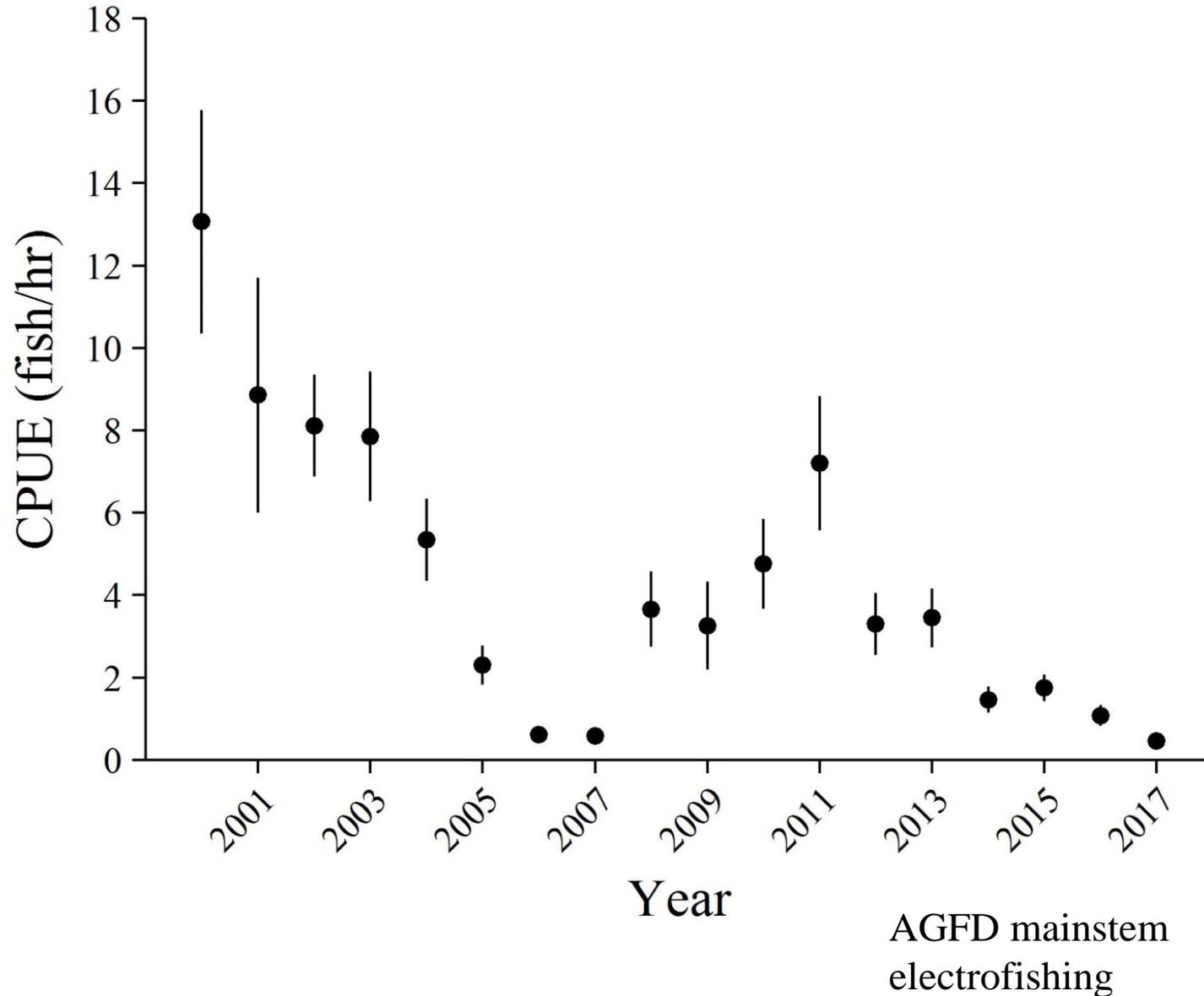


# Brown Trout and Carp captured in the Co R by river mile in 2017

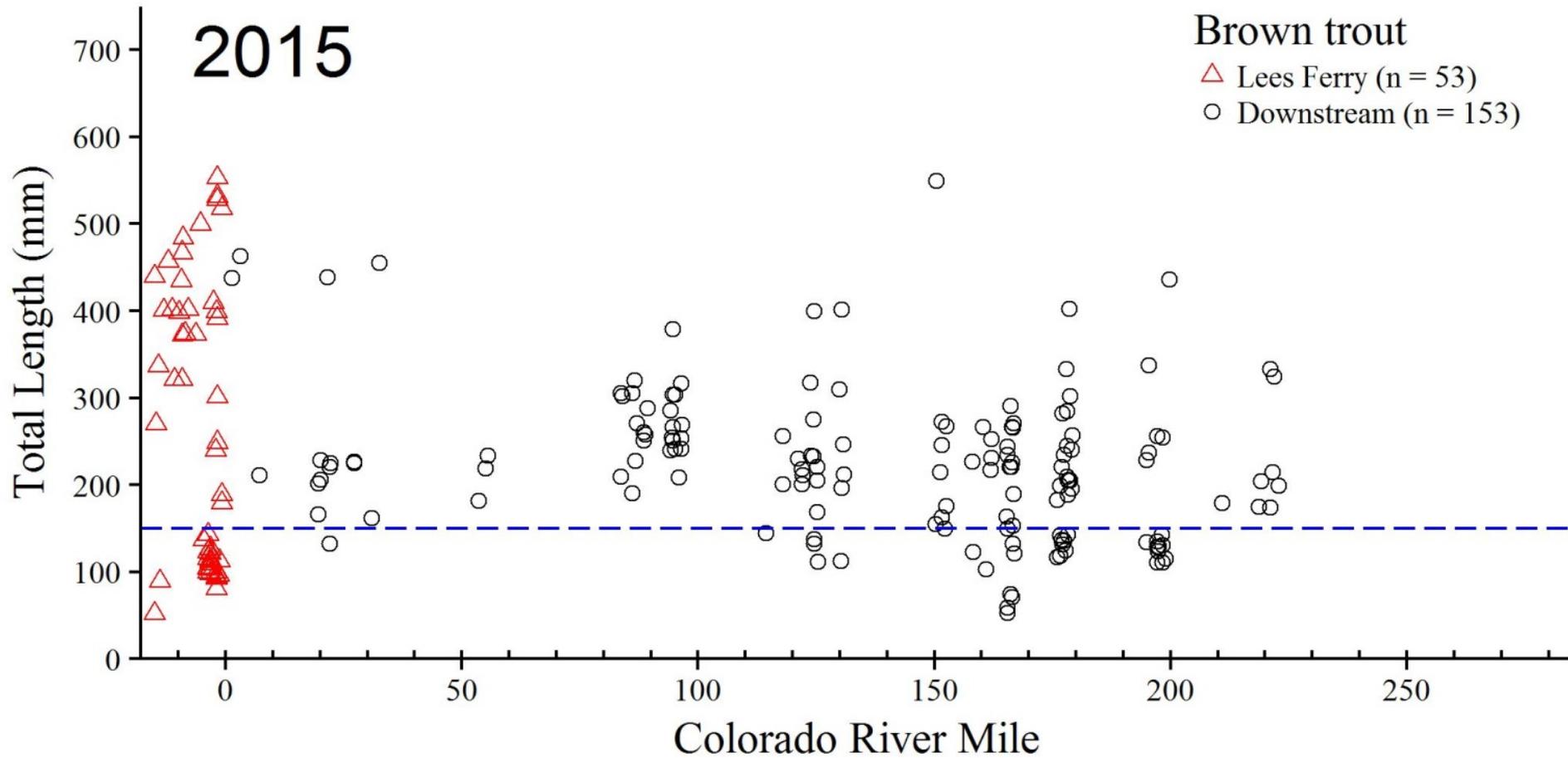
- Common Carp
- Brown Trout



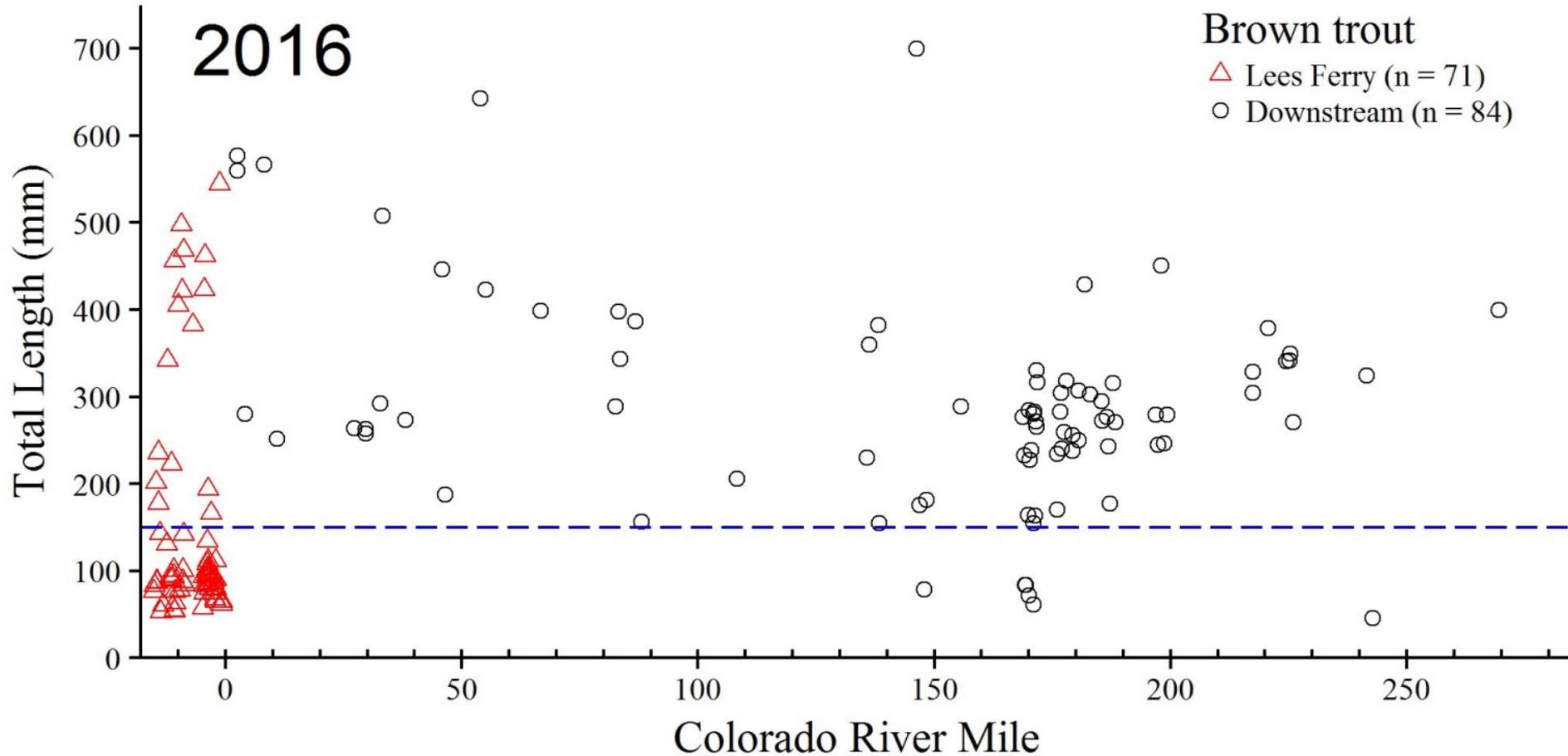
# Riverwide Brown Trout CPUE



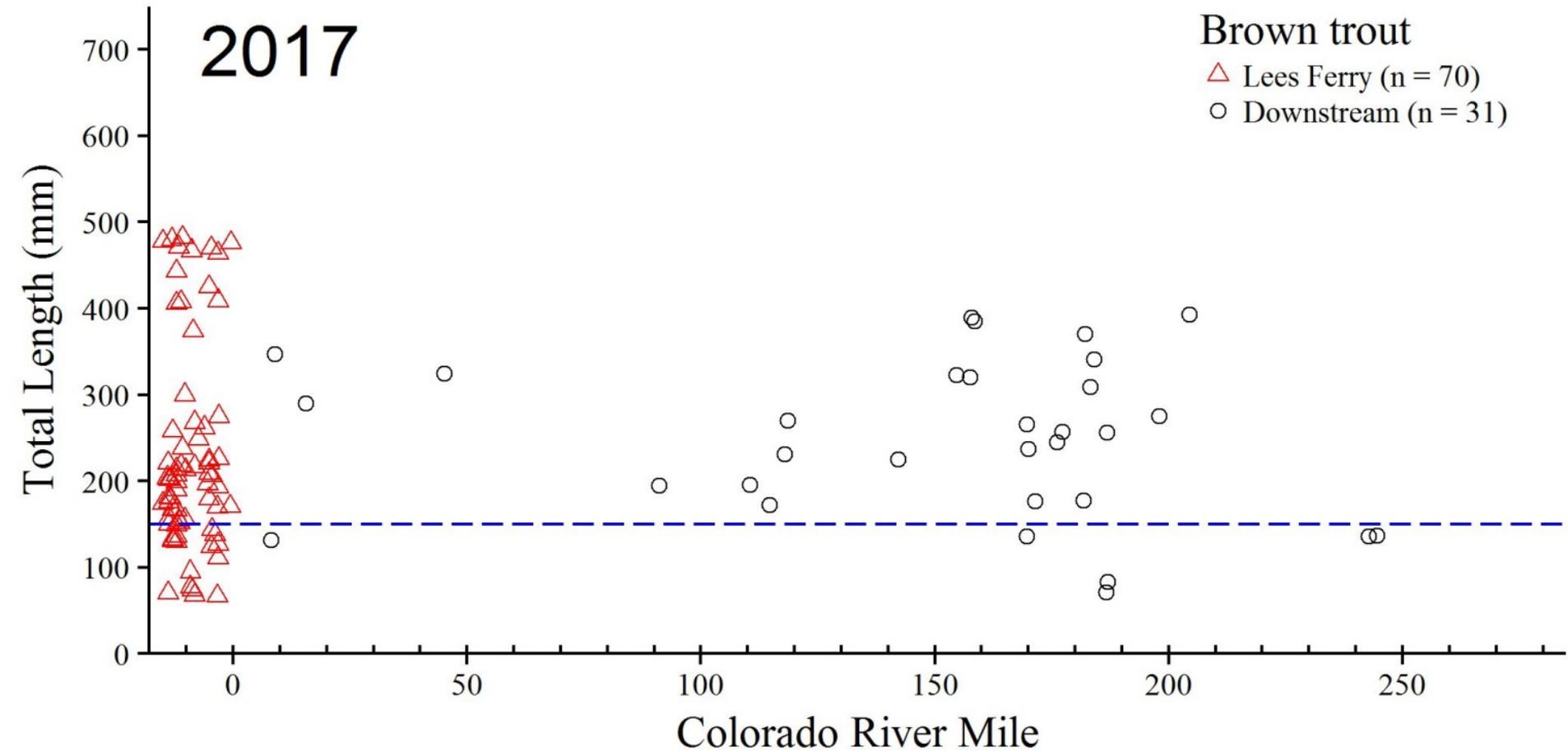
# AGFD Lees Ferry and Grand Canyon fish monitoring data 2015-2017



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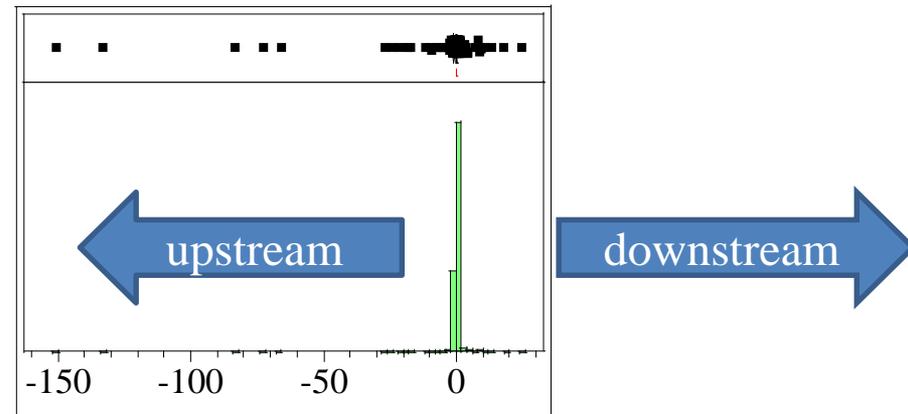


# Brown Trout Movement

594 unique fish with recapture data  
(1984-2016)

Direction	Number	Average mi. moved [95% CI]
None (<1 mi)	237	0
downstream	160	1.30 [0.813, 3.12]
upstream	195	-4.70 [-1.65, -7.77]

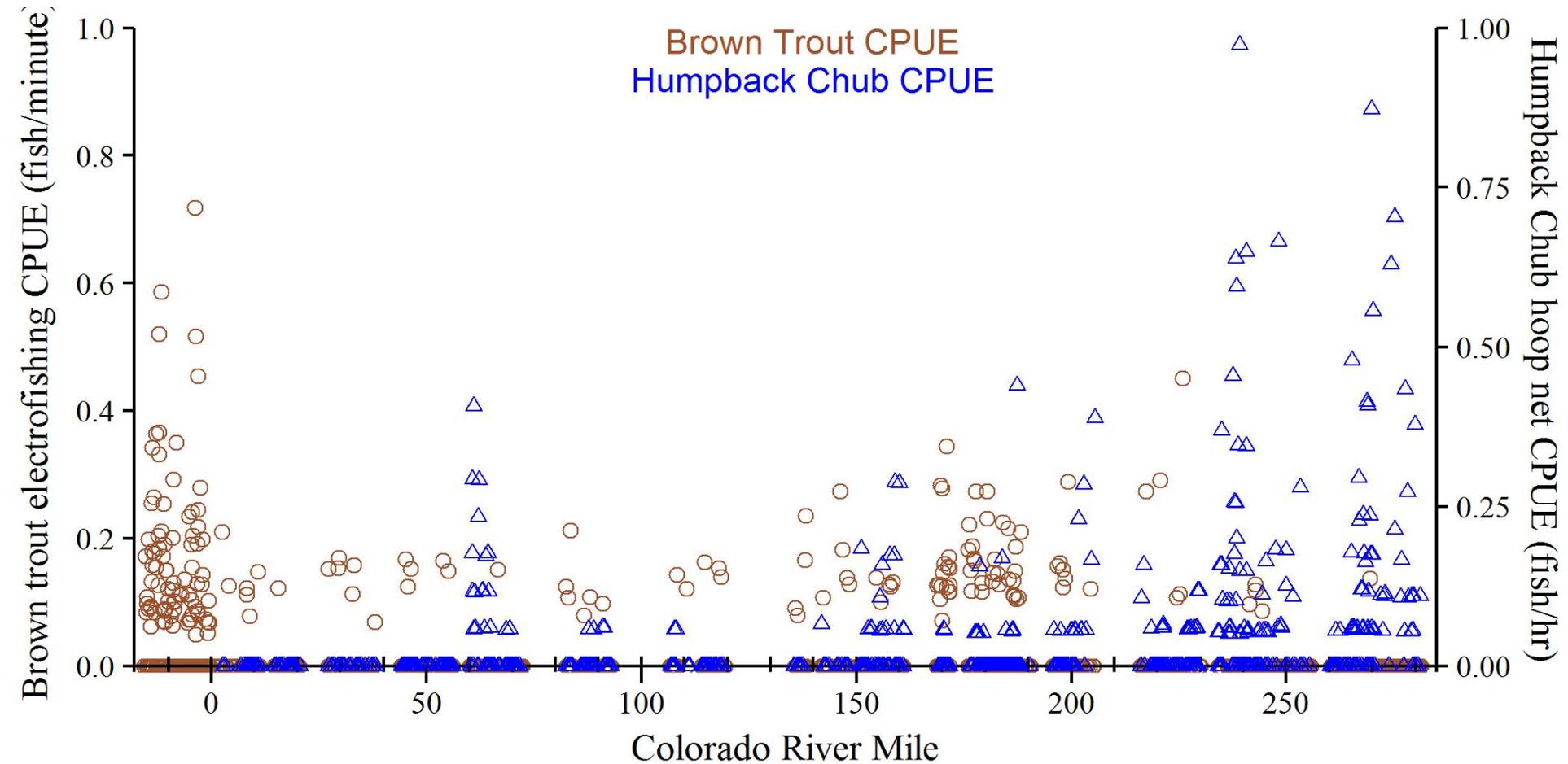
Of Brown Trout that move,  
statistically there is no  
preference for going upstream  
compared to downstream  
( $p = 0.071$ )



# Brown Trout and Humpback Chub by river mile

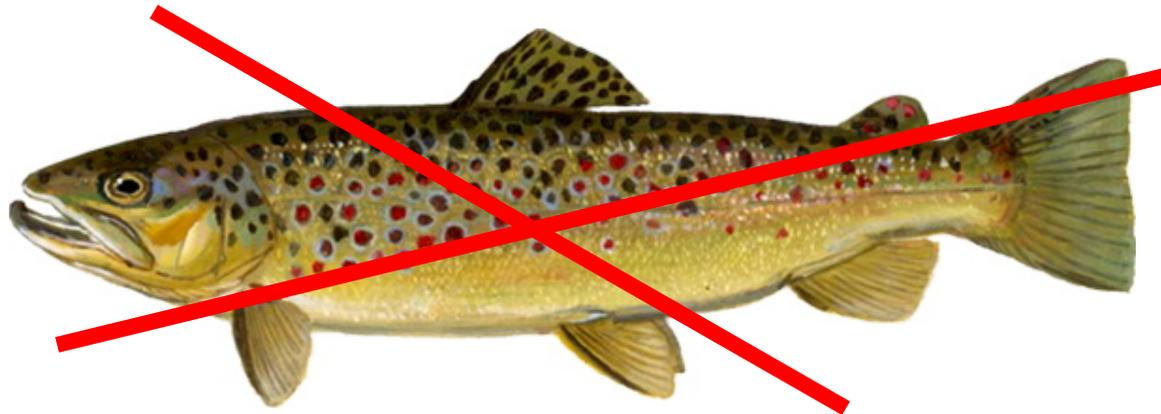


2016-2017



# What is being done?

- National Park Service and USGS – radio tagged 20 Brown Trout at Lees Ferry and are tracking their movements
- National Park Service has implemented a permit policy of all incidental catches of Brown Trout to be removed for beneficial use when practical.



# Conclusions

- Are Brown Trout a major concern at Lees Ferry?
  - depends
    - Don't think they will replace Rainbow Trout but might be a more mixed fishery
    - Not sure if they will move downstream and predate on Humpback Chub
    - But – there are already Brown Trout downstream of Lees Ferry





# Acknowledgements

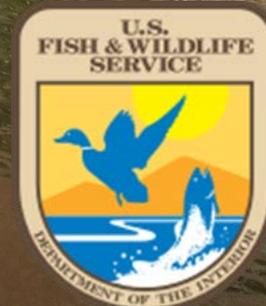


Pilar Wolters

Boatmen: Humphrey Summit & Saint Judes Ltd.

Past & present agency personnel, and volunteers

Steve Harding, Lees Ferry Anglers



**Table 4. Trip summary for Arizona Game and Fish Department’s standardized monitoring (boat electrofishing) of the Lees Ferry Fishery for 2017 (does not include supplemental sample sites e.g. specific nonnative-efforts)**

<b>Trip</b>	<b>Date</b>	<b>n</b>	<b>Rainbow Trout</b>	<b>Brown Trout</b>	<b>Common Carp</b>	<b>Flannelmouth Sucker</b>	<b>Green Sunfish</b>	<b>Walleye</b>
Spring	14-17 March	41	551	37	2	3	0	0
Summer*	17-21 July	41	1178	15	0	0	1	0
Fall	12-15 September	40	2458	16	5	17	1	0
	Total fish		4187	68	7	20	2	0
	Percent of catch		97.7	1.59	0.163	0.467	0.0467	0