The Physiological Effects of Resident Killifish Impacted by the Deepwater Horizon Oil Spill

Fernando Galvez, Benjamin Dubansky, Charlotte Bodinier, Andrew Whitehead

Dept. of Biological Sciences, Louisiana State University

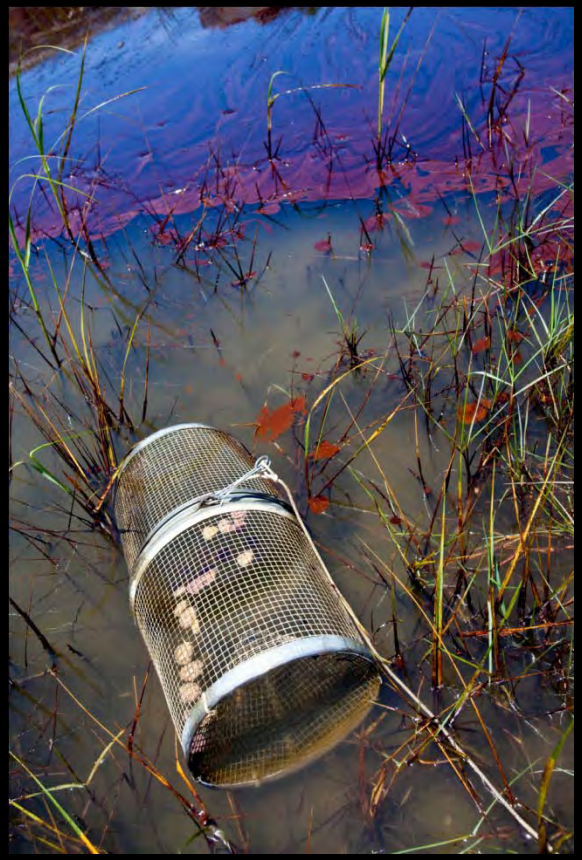
BP Deepwater Horizon- April 20, 2010

Approximately 2500 miles of boom were deployed along the coast


Photo: Andrew Whitehead

Photo: Benjamin Dubansky

Photo: Benjamin Dubansky




LSU

Gulf Killifish

- Widely distributed, but likely have limited home range
- Important in estuarine food webs
- Suitable for laboratory experimentation
- Excellent ecological, physiological and genetic information available
- Rapid development
- Large (2 mm) transparent eggs

Photo: Andrew Whitehead

Experimental Design

Objectives: Track marsh fish health before oil, during oil exposure, and during a recovery period to characterize oil spill impact on exposed Gulf Coast marshes.

1. Measure **tissue-specific responses** to oil-exposed fish ***in situ***.
   - Physiology- Protein-level expression changes.
   - Molecular- Genome-wide mRNA transcript changes.
   - Hydrocarbon analyses in water, sediments, and fish carcass.

2. Test the effects of exposure of embryos to field-collected waters and sediments
   - Fertilization success, time-to-hatch, hatching success, gene expression

Deepwater Horizon oil spill – field study

Genomic and physiological footprint of the *Deepwater Horizon* oil spill on resident marsh fishes

Andrew Whitehead[a,1], Benjamin Dubansky[a], Charlotte Bodinier[a], Tzintzuni I. Garcia[b], Scott Miles[c], Chet Pilley[d], Vandana Raghunathan[e], Jennifer L. Roach[a], Nan Walker[e], Ronald B. Walter[b], Charles D. Rice[f], and Fernando Galvez[a]

Departments of [a]Biological Sciences, [c]Environmental Sciences, and [e]Oceanography and Coastal Sciences, and [d]Coastal Studies Institute, Louisiana State University, Baton Rouge, LA 70803; [b]Department of Chemistry and Biochemistry, Texas State University, San Marcos, TX 78666; and [f]Department of Biological Sciences, Clemson University, Clemson, SC 29634

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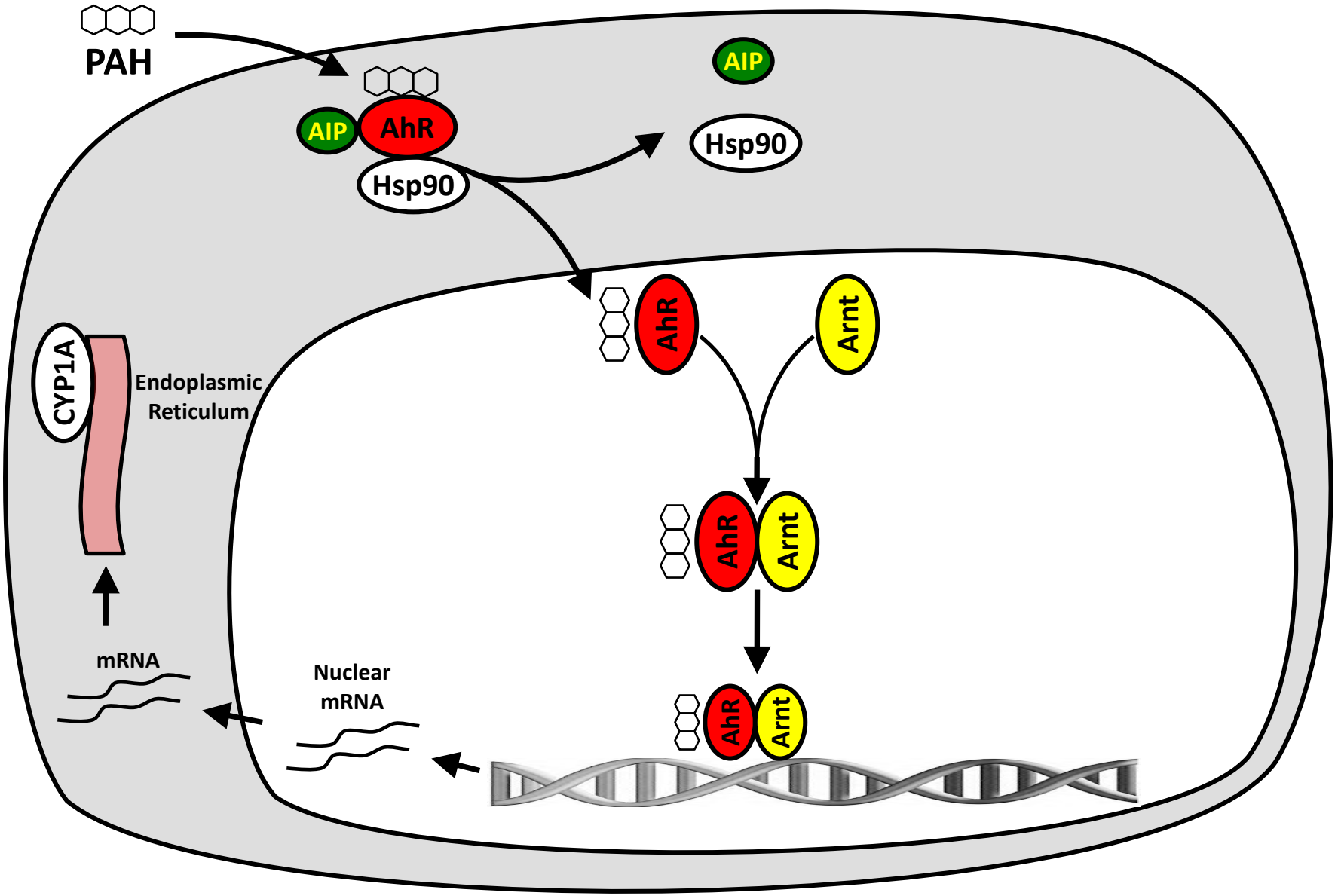
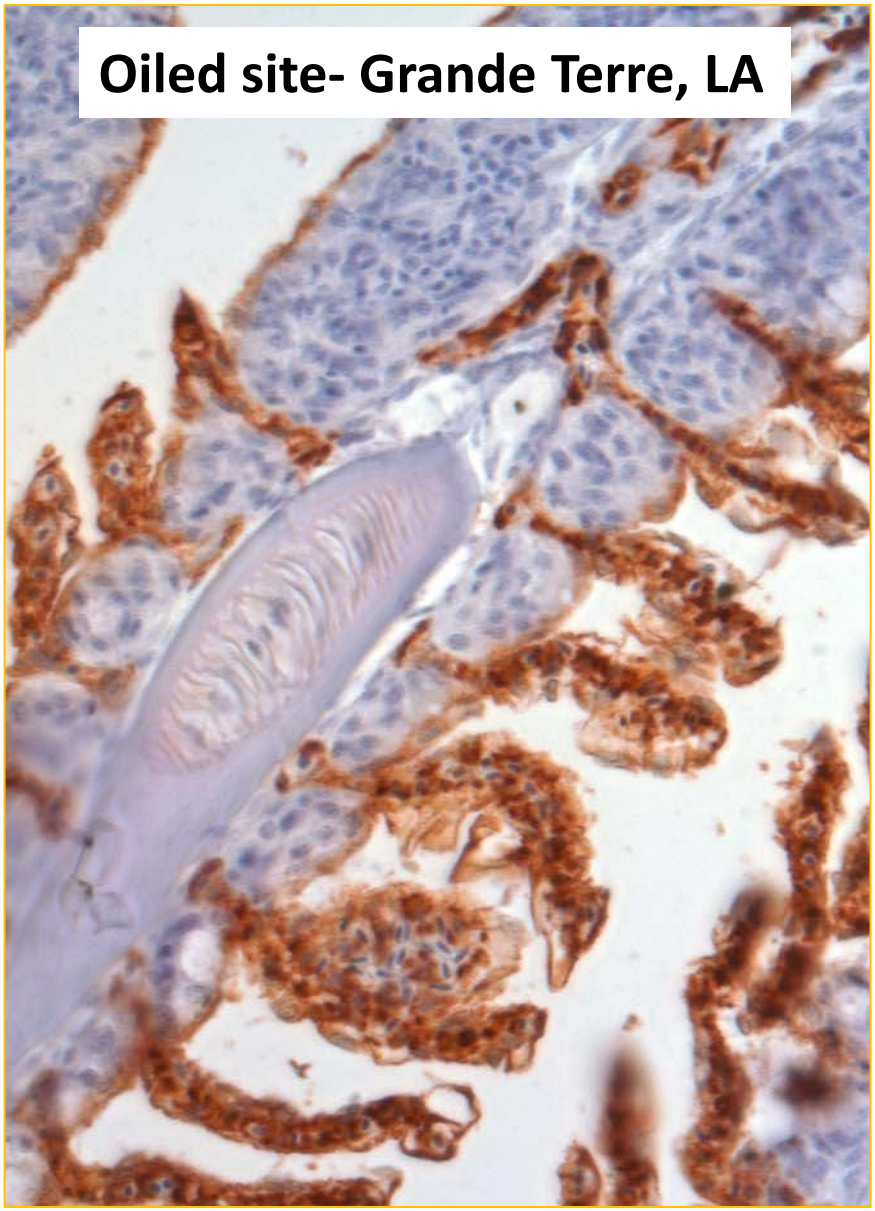
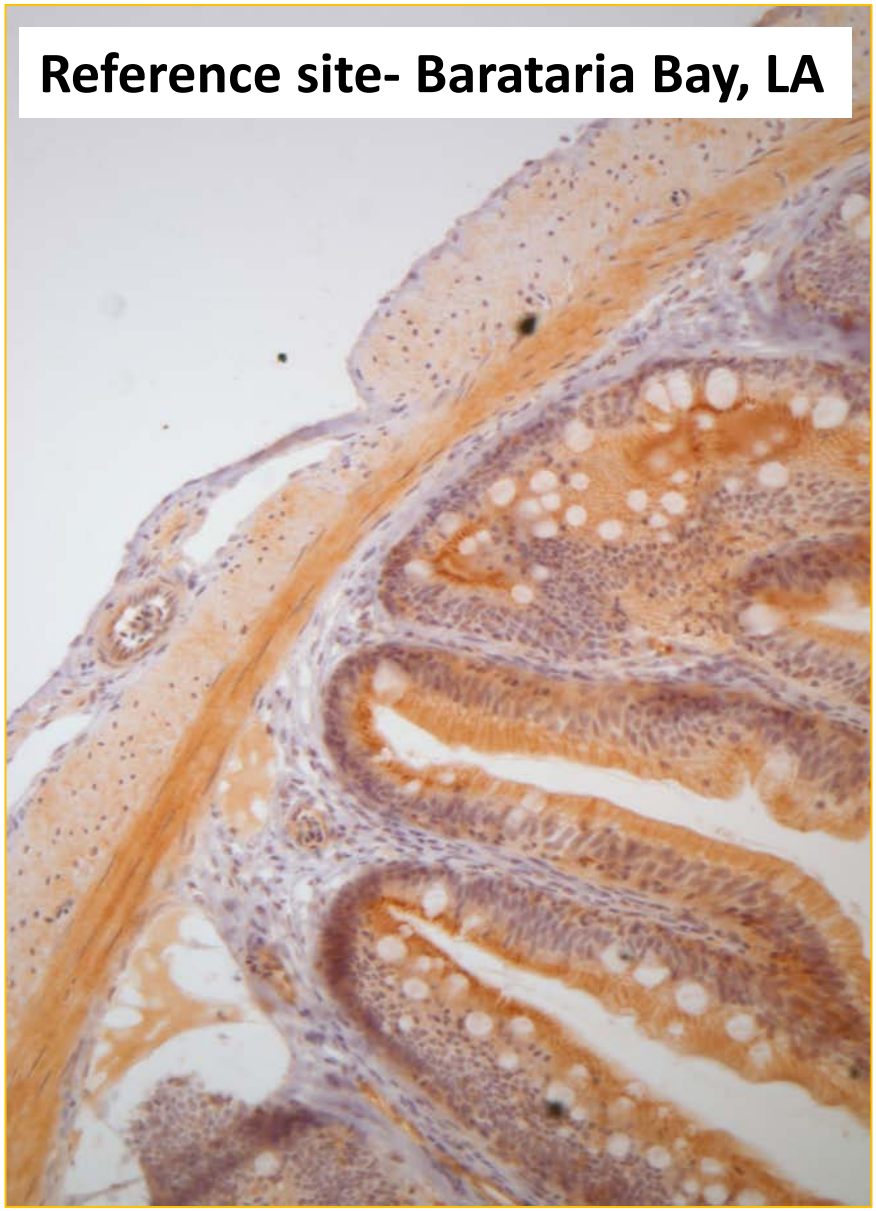
Induction of CYP1A

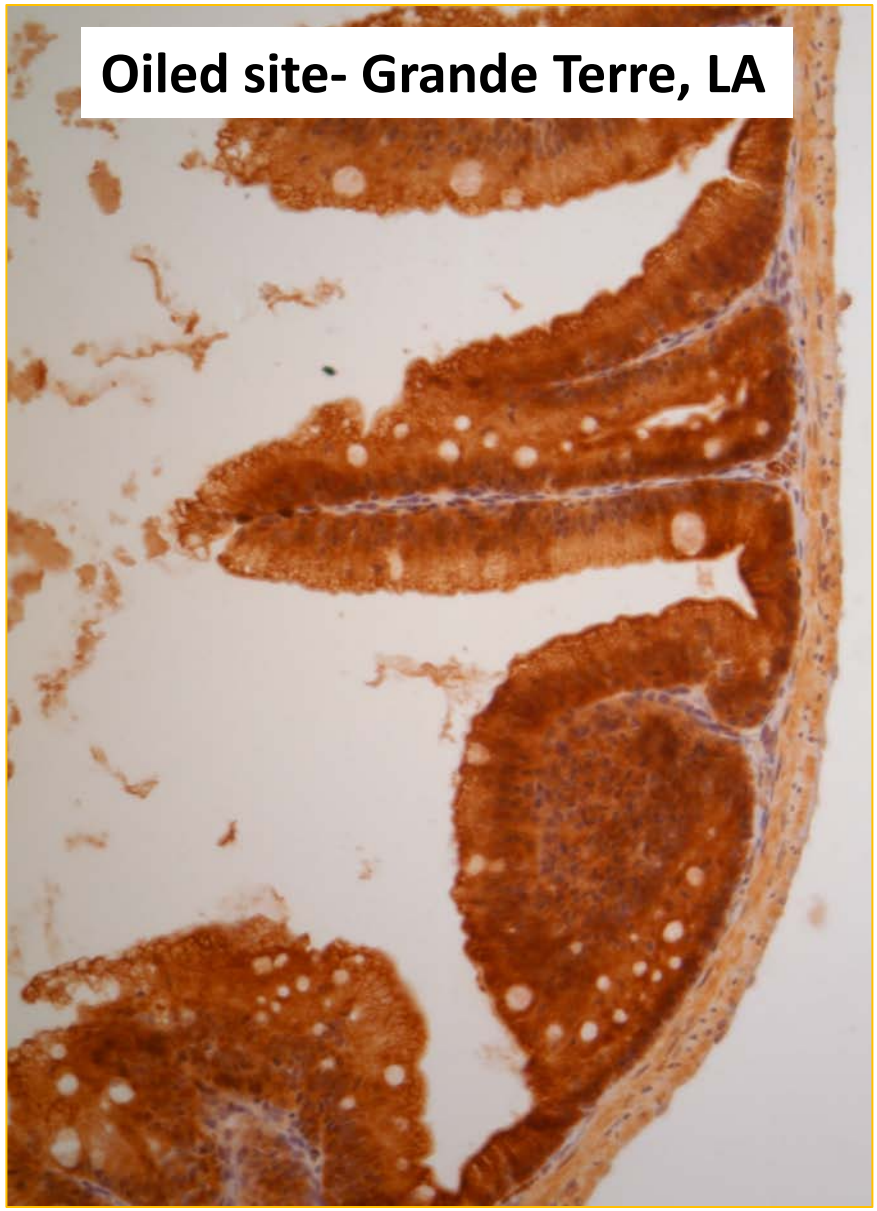


CYP1a protein expression in killifish gills

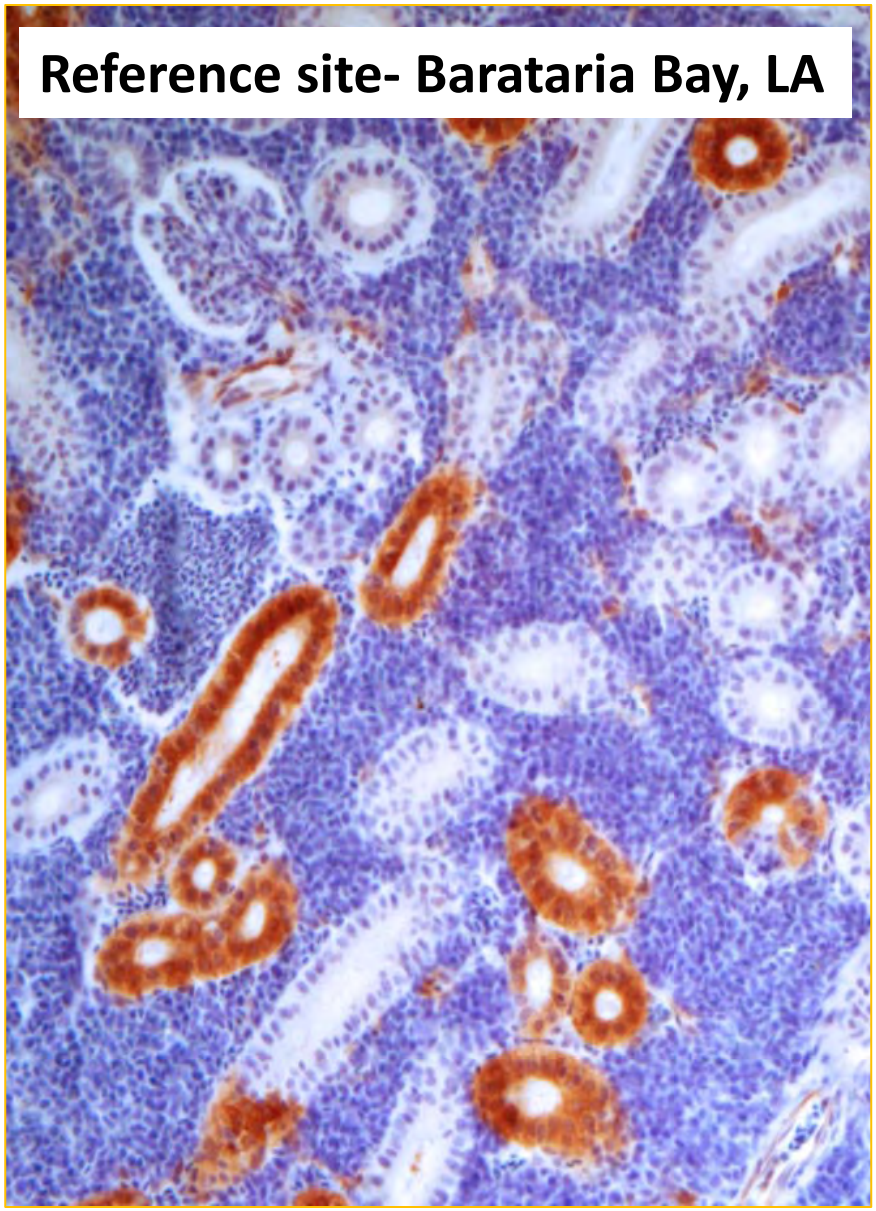


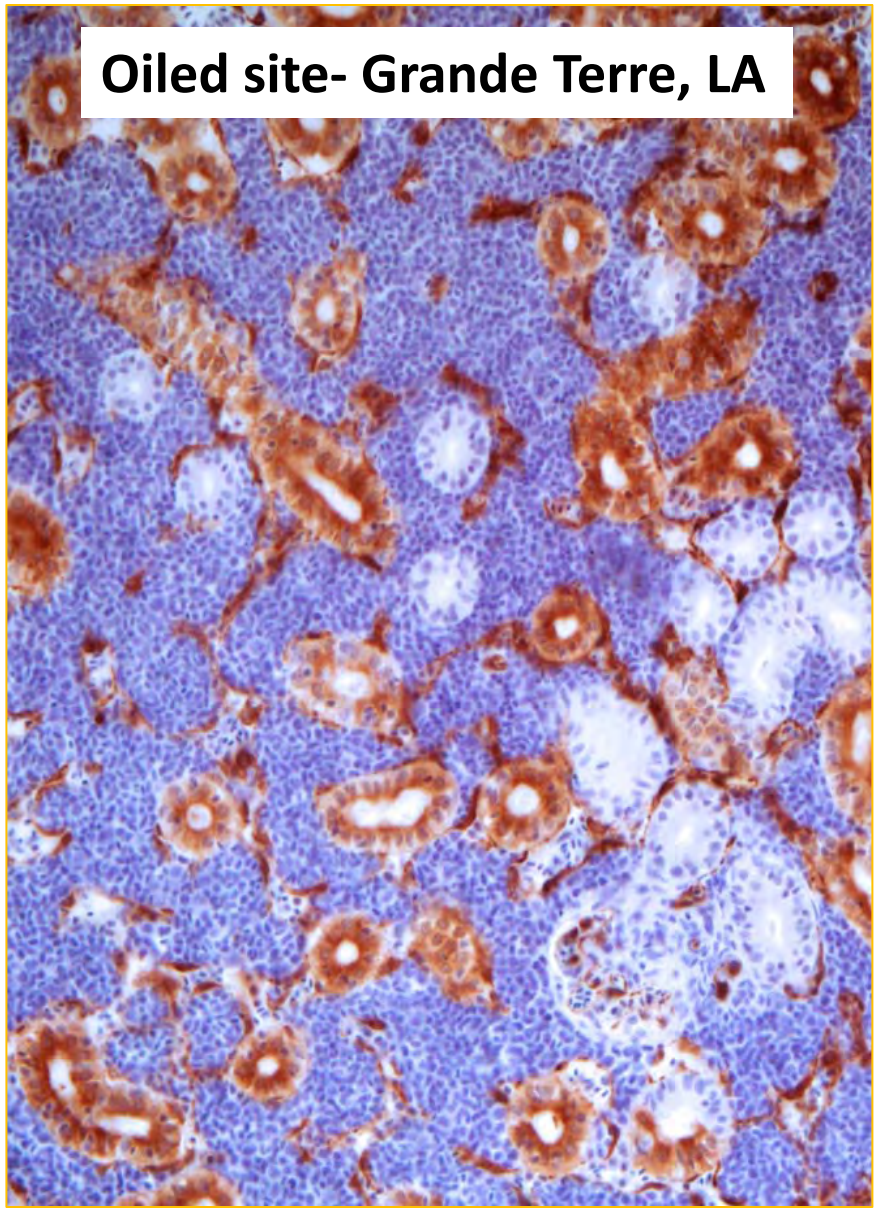
CYP1a protein expression in killifish intestine





CYP1a in killifish kidney





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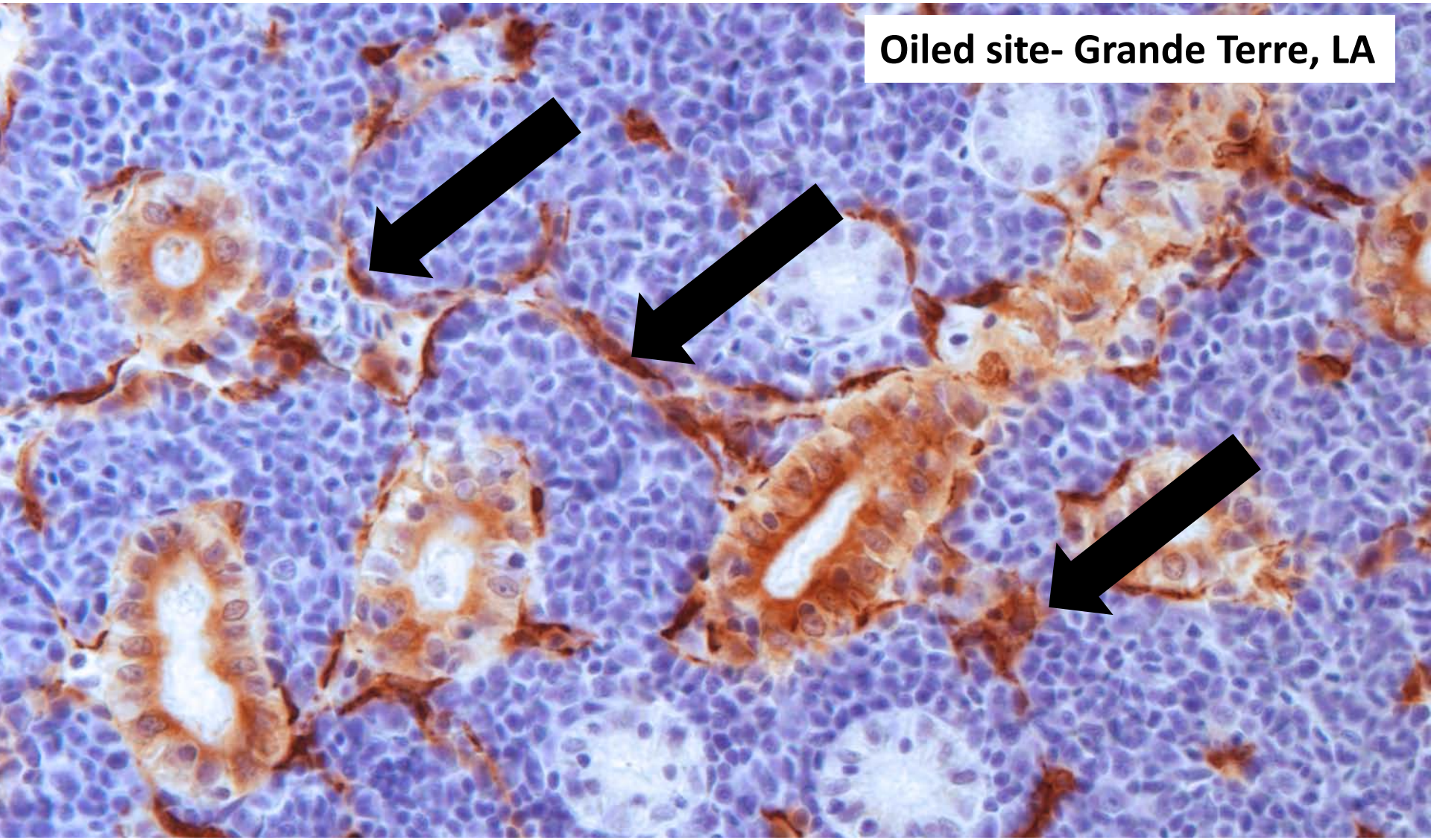
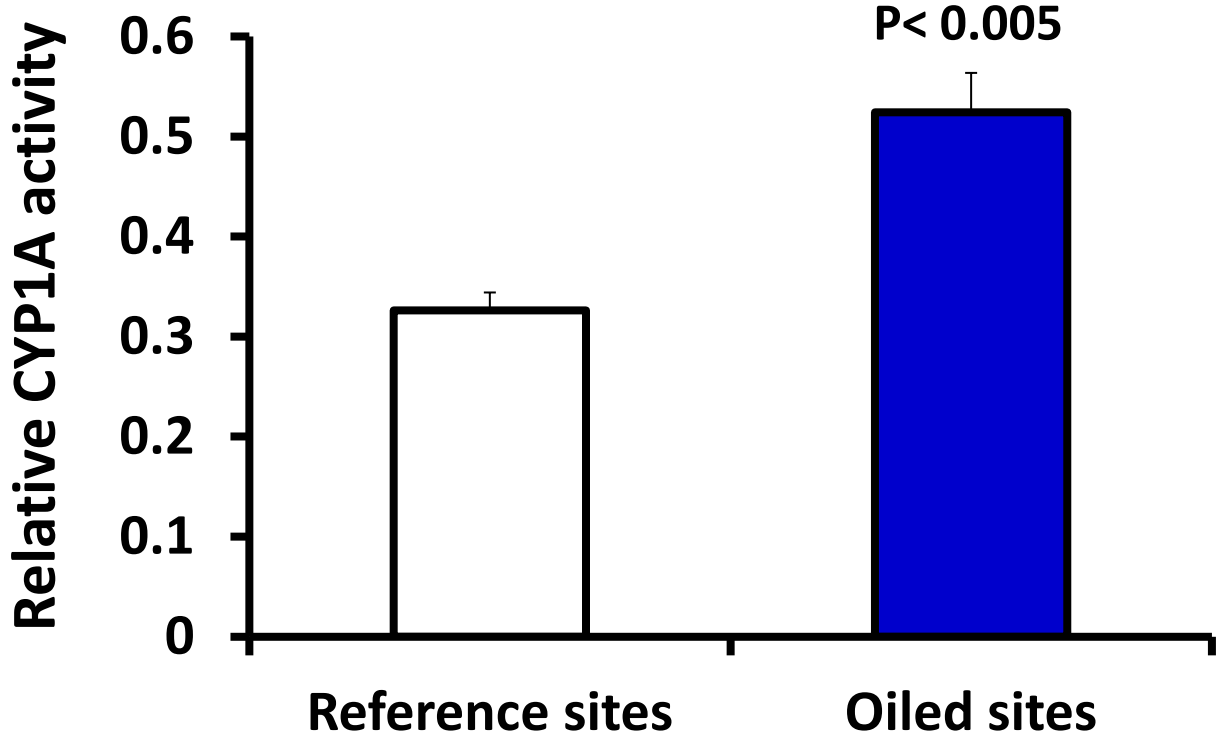


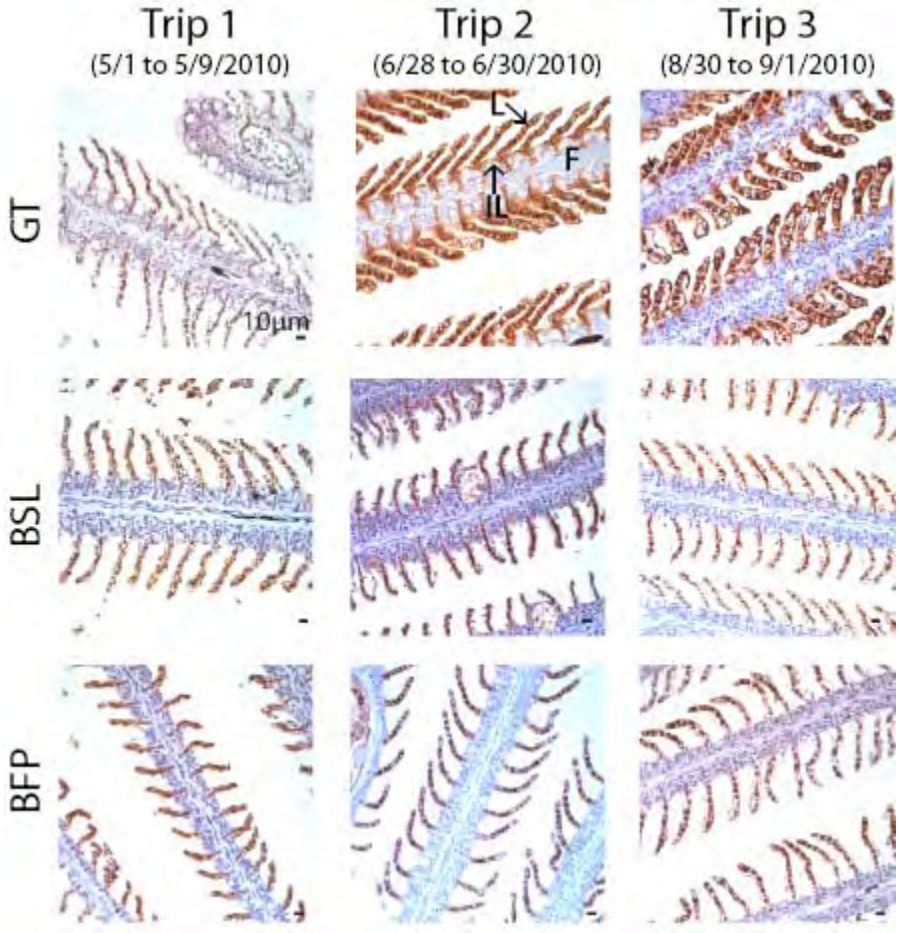
CYP1a in killifish liver

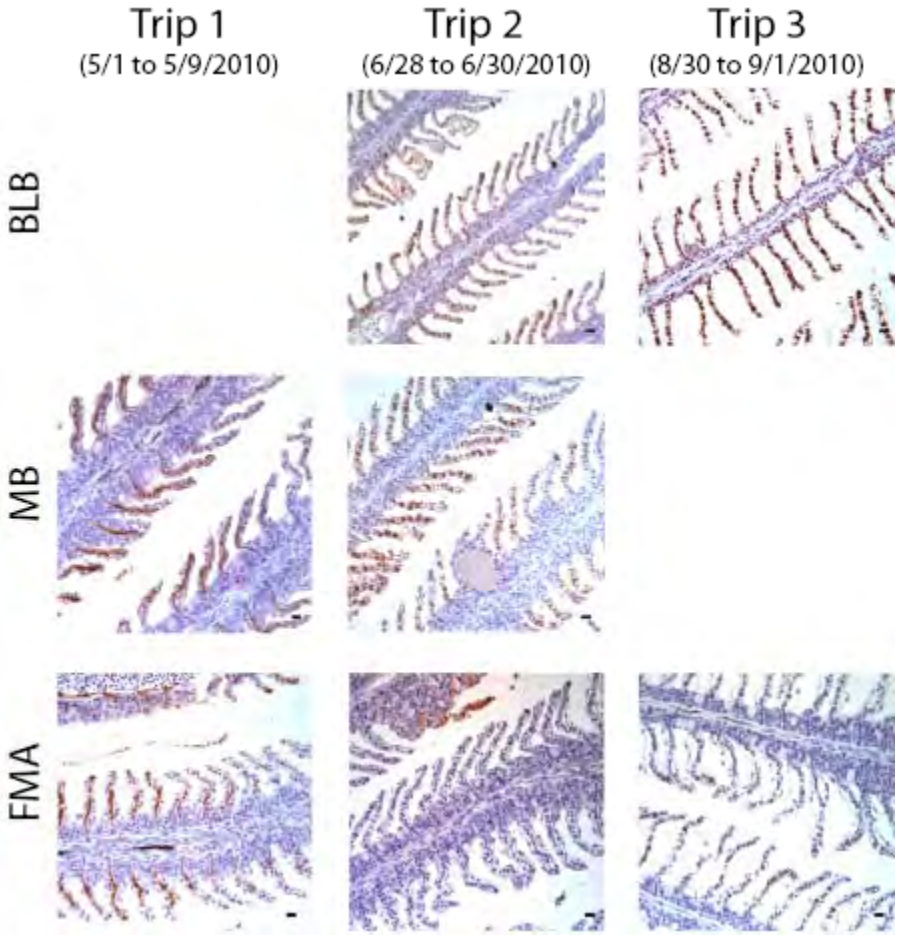
Reference site- Barataria Bay, LA

Oiled site- Grande Terre, LA



Gill CYP1a in killifish gill at different field sites

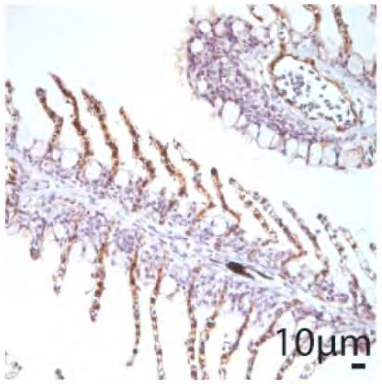




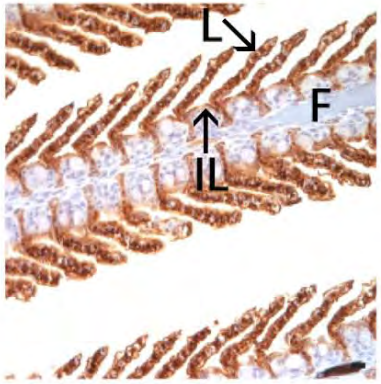
Gill CYP1a in killifish gill at Grande Terre, LA over time

GT

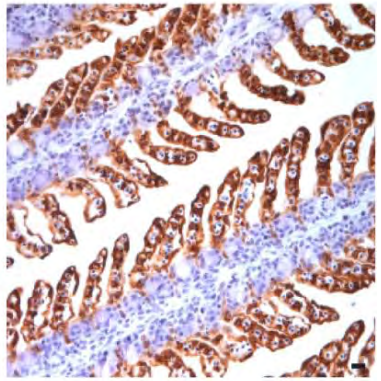
Trip 1
(5/1 to 5/9/2010)



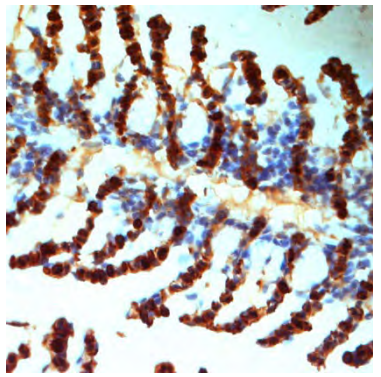
Trip 2
(6/28 to 6/30/2010)



Trip 3
(8/30 to 9/1/2010)



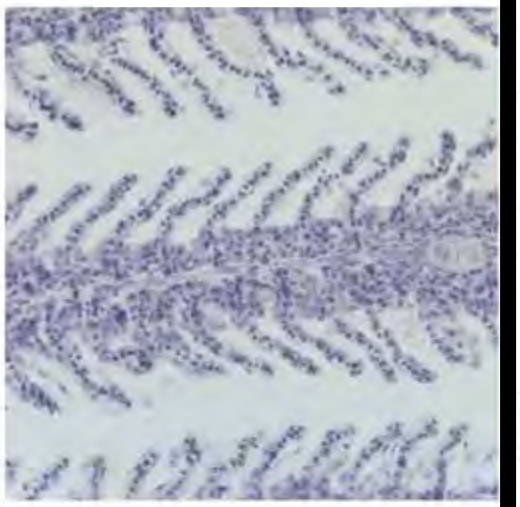
Trip 4
8/7/2011

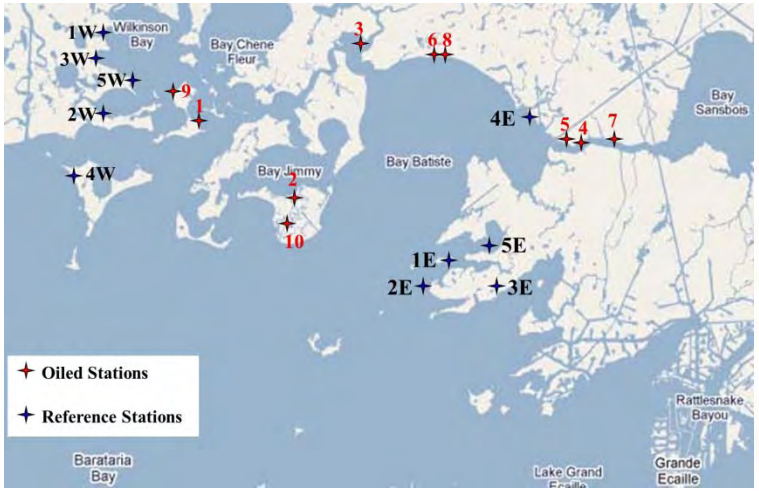


Dark red stain = CYP1A protein in gills from fish collected *in situ*
Blue stain = hematoxylin (nuclei)

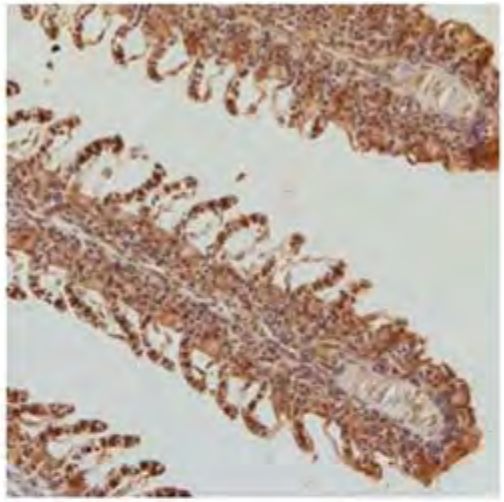
Gill CYP1a Protein Expression is Upregulated in Fish Throughout Oiled Sites in Barataria Bay

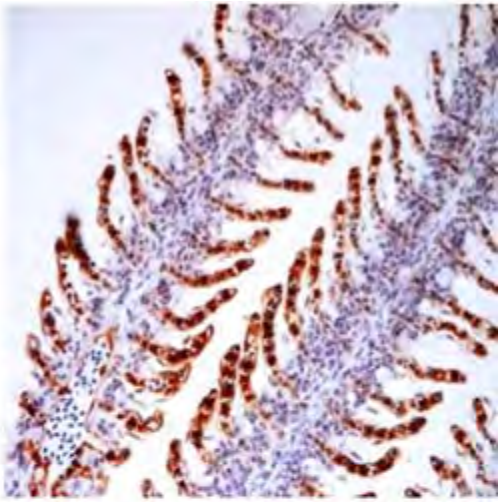
Reference

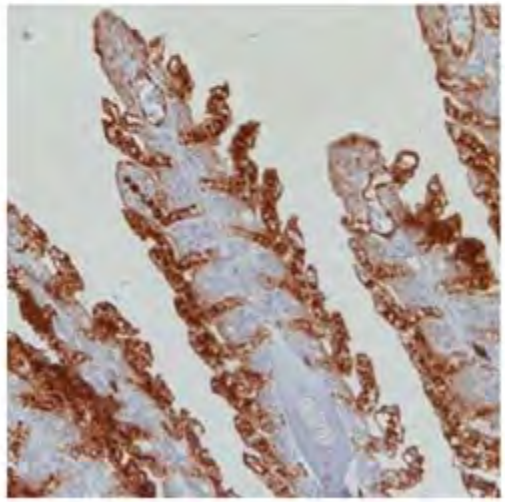


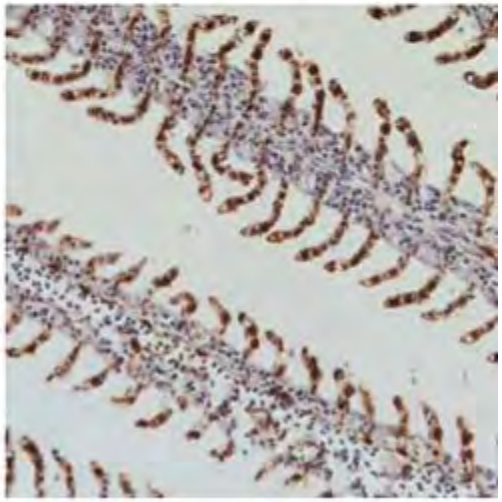


Oiled Sites – Barataria Bay, LA









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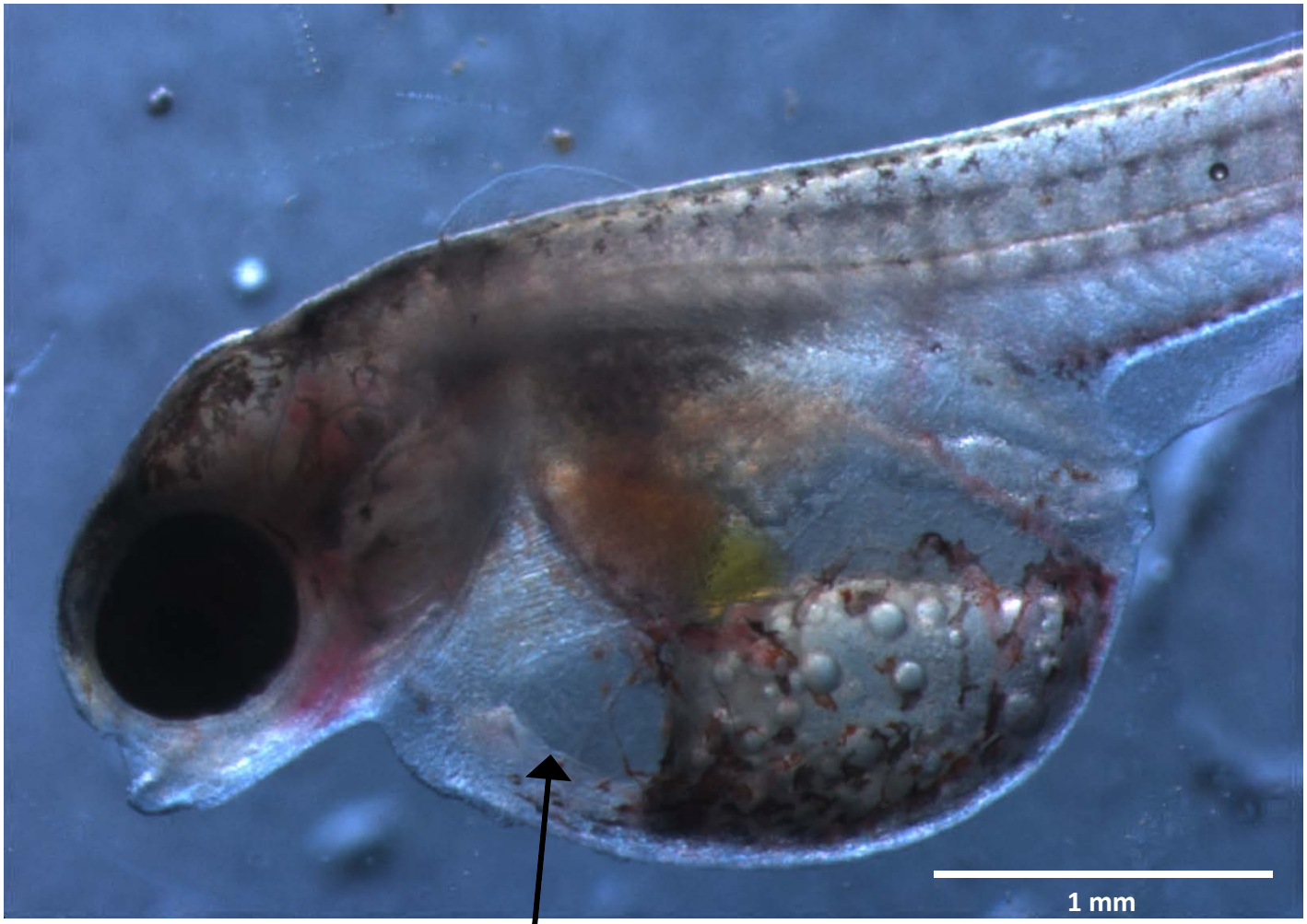
Early life-stage exposures to field-collected Barataria Bay sediments



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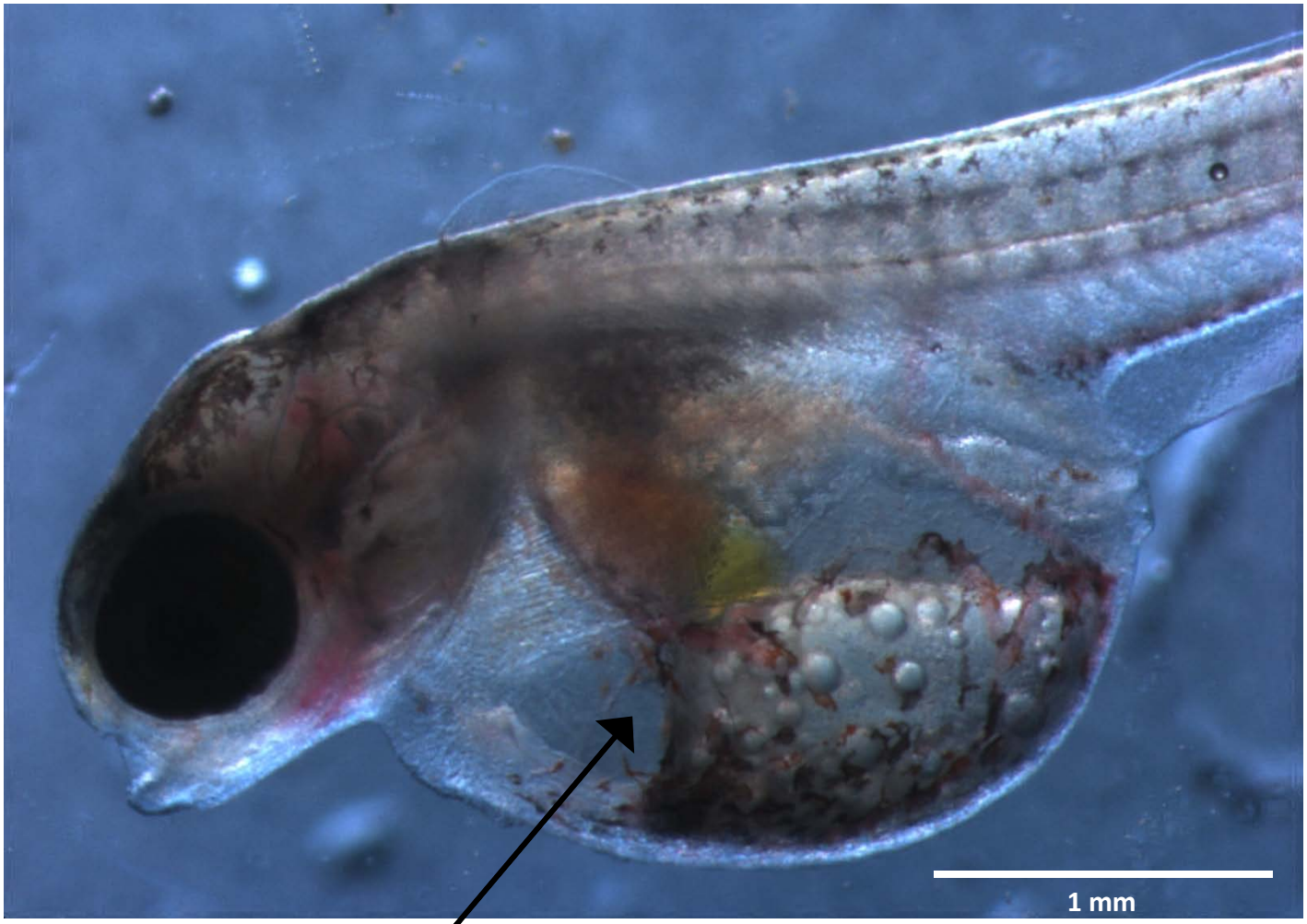

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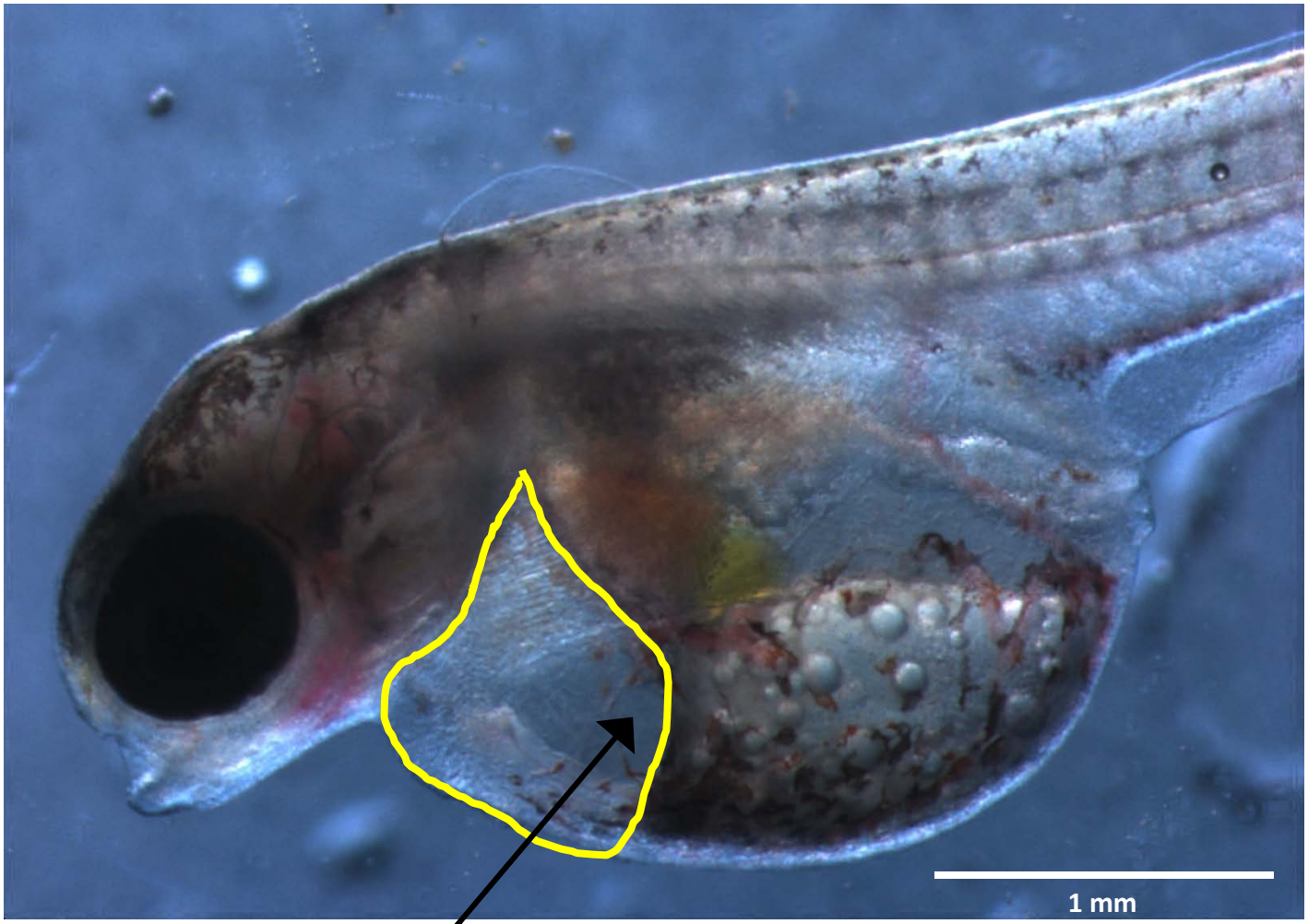
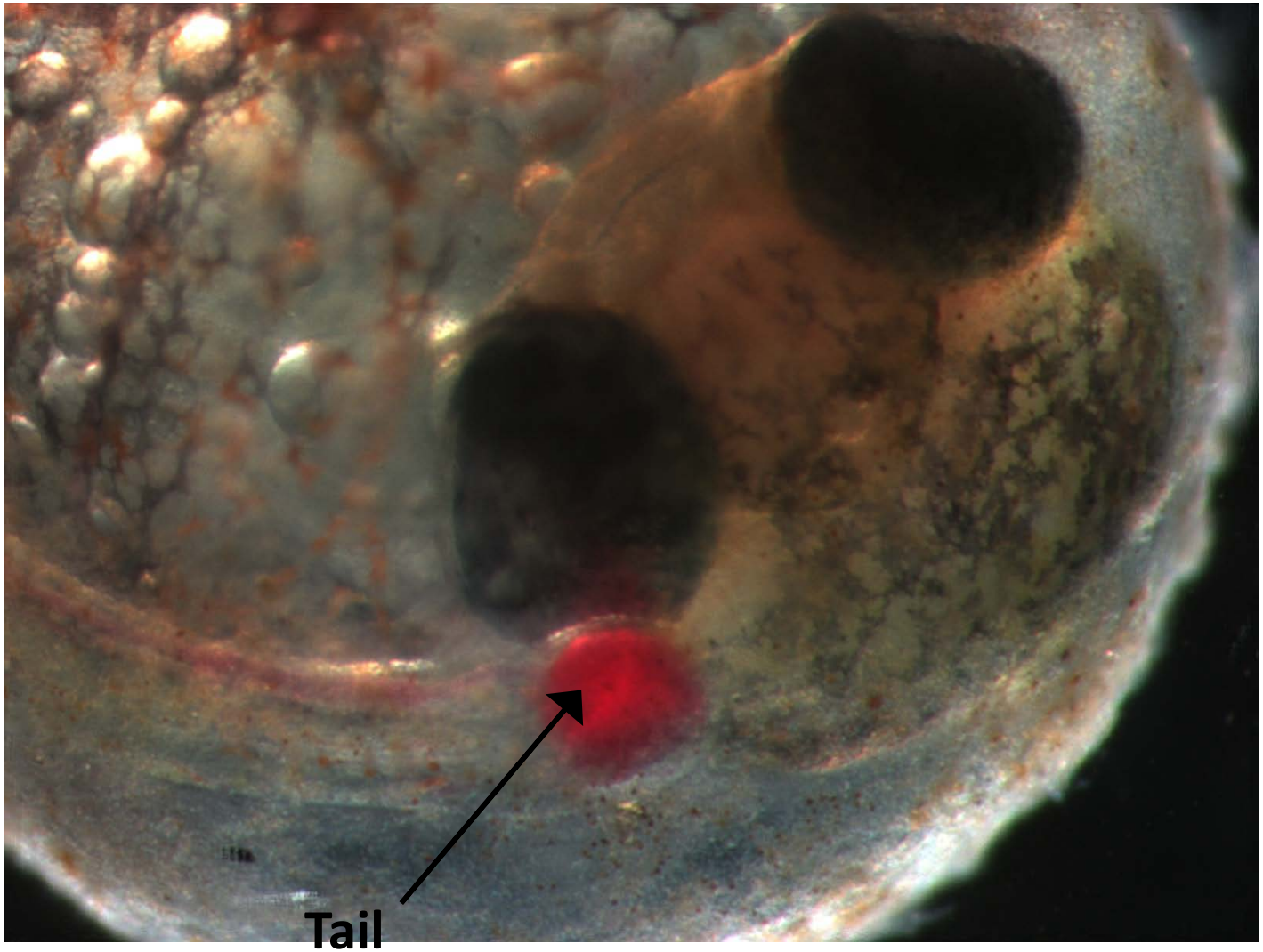


Huge pericardial space

Pericardial edema

Early life-stage exposures to field-collected Barataria Bay sediments

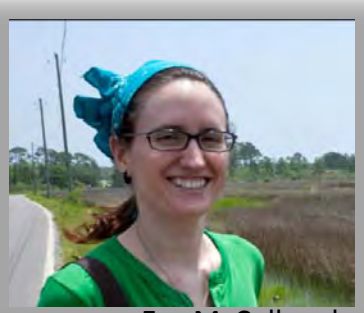


DWH Oil Spill: Conclusions

- Large signal of hydrocarbon exposure exists in Louisiana marsh fish collected *in situ.*
- CYP1a expression is highly elevated in the gills, intestine, and kidney of fish collected from oil-contaminated sites.
- Exposure to field-collected sediments increases time-to-hatch and reduces the percent hatch of killifish embryos.
- Exposure to field-collected waters has no discernible effects on embryonic/larval survivorship, but does increase CYP1a levels in tissues.

Physiological Genomics


Jen Roach


Eve McCullough

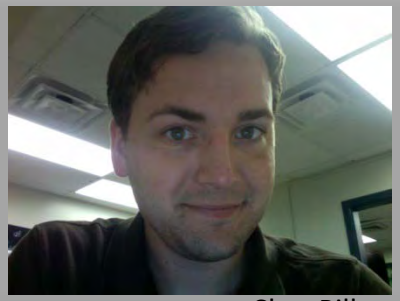

David Roberts

Tissue Histochemistry


Ben Dubansky


Charlotte Bodinier

Remote Sensing


Chet Pilley


Vandana Raghunathan

RNAseq


Tzintzuni Garcia

Analytical Chemistry

Acknowledgements

Galvez Lab:

- Shujun Zhang (Graduate Student)
- Ling Meng (Graduate Student)
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- Lee McChesney (Undergraduate)
- (undergraduate)
- Ryan Roberson (undergraduate)

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- Jen Roach (Research Associate)
- Eve McCullough (Graduate student)
- Whitney Pilcher (Graduate student)
- Reid Brennan (Graduate student)
- David Roberts (undergraduate)
- Stephen Horne (undergraduate)
- Walter Guillory (undergraduate)

Collaborators:

- Chris Green (LSU)
- Nan Walker (LSU)
- Scott Miles (LSU)
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- Ron Walter (TX State U)