

# UPDATE ON AIS PREVENTION AND CONTROL EFFORTS IN PUERTO RICO

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# THE FOUR MAJOR INVASIVE AQUATIC PLANT SPECIES







Waterhyacinth at Lake Carraízo



# Waterlettuce at Lake La Plata





# Hydrilla at irrigation/drainage canals





# Giant salvinia at Lake Las Curias





# Water bodies in Puerto Rico

## ■ Use

- Recreational – fishing
- Water supply and power generation
- Wildlife refuge – migratory birds

## ■ Problem

- Aquarium and horticultural trade – landscapes
- Shallow man-made lakes
  - High sedimentation
  - Eutrophic : 32% -  $P > 0.05$  ppm (PREQB 2008)
- Distorted public perception to management techniques
  - Specifically herbicides



Giant sal

\$





# Grupo Antillano de Especies Invasoras

- Multidiscipline group of the College of Agricultural Sciences, UPR, Mayagüez
  - Since year 2010
  - Faculty, Extension Service and Agricultural Experiment Station
    - Botany, Entomology, Weed Science, and Landscape Architecture
- Colaborators
  - Scientists from Mississippi State University





# GAEI Main Goals

- Raise citizen awareness regarding the importance of invasive species on ecosystems
- Prevention of invasive species introduction and spread using a regional-focused EDRR program



# GAEI Objectives

- To develop hands-on training workshops for general public
- To develop a web-based information and monitoring system available for general public
- Bottom line – get EXTRA HELP!!



# Target Species

7 plant species

6 present

1 not present

6 insect species

3 present

3 not present

Waterhyacinth



Mediterranean Fruit Fly



Tropical Soda Apple



Mango Seed Weevil





# Training workshops

- 1 day workshop offered at many locations throughout the island including Vieques
- Topics covered:
  - Invasive Species Concepts
  - Insect Collection, Mounting and ID
  - Plant Collection, Mounting and ID
  - How to Use a Handheld GPS Unit?
  - Atlas Website Use

# Insect Collection – Dr. Franqui



Mayaguez, PR



# Plant Mounting



Vieques, PR



# Insect ID – Dr. Gonzalez



Camuy, PR



# Atlas website – Mr. González





# GPS Use – Mr. Almodovar



Camuy, PR

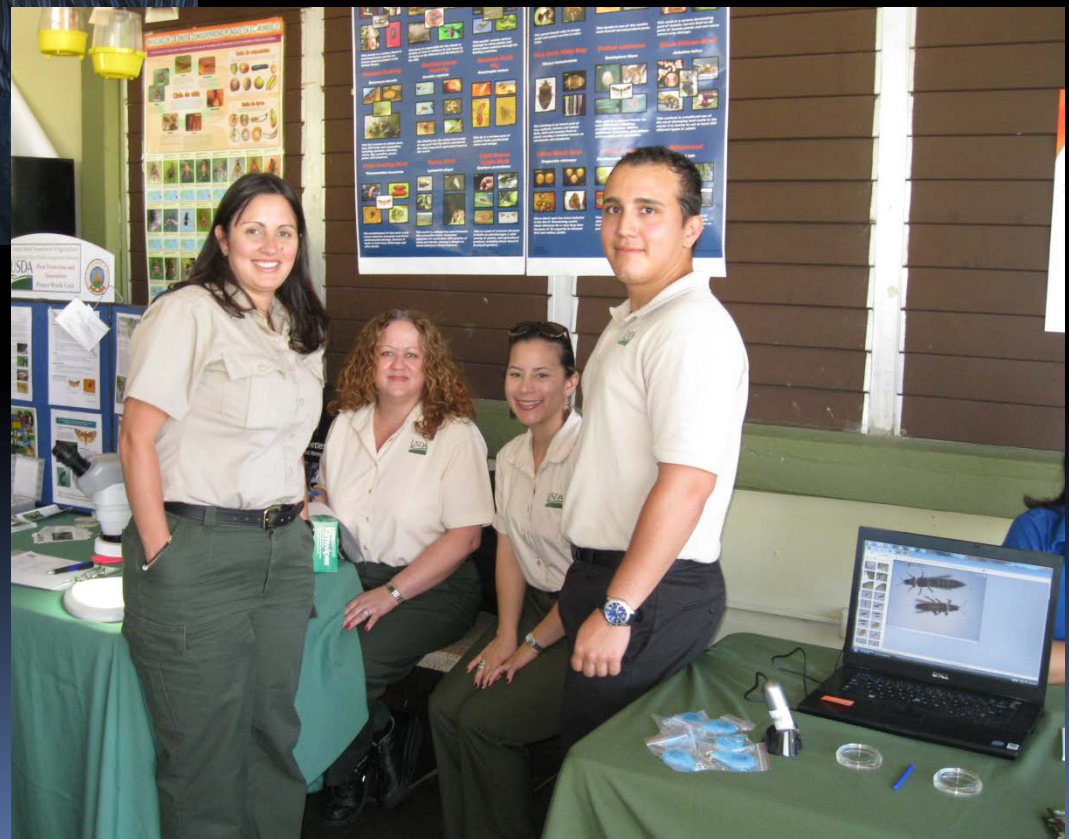




## Semana Nacional de Concienciación sobre Especies Invasoras



**3-8 marzo 2013  
Puerto Rico**







Sierra Club  
Environmental Non-profit  
Organization



# Main Results

- Training Workshops – >200 attendees
  - Age: 12-60 years old
  - Educational background: mid-high school, bachelor and masters (science major)
  - Citizen group: boy scouts, university (student, professor, technician), state/federal employee, non-profit organization
- General knowledge about Invasive Species...**NONE**



# Atlas de Especies Invasoras de PR

<http://atlas.eea.uprm.edu/>





# Atlas de Especies Invasoras de PR

- Launched in April 2011
- Currently in Spanish language
- Web-based monitoring and information system that includes:
  - Fact Sheets
  - Invasive Species Distribution Maps - database
  - Blogs and updated news articles
  - Outreach materials

# Atlas de Especies Invasoras de Puerto Rico

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SEARCH

INICIO

CONÓCENOS

EVENTOS

MAPA DE DISTRIBUCIÓN



Un lagarto sabana monitor y varias especies de ranas peligrosas para la fauna de Puerto Rico, como las aves y coquíes, fueron incautadas por Recursos Naturales. (Suministrada / DRNA)

August 16, 2016 07:46 AM

## Incautan especies exóticas descritas como depredadores voraces

Se trata de un lagarto sabana monitor y varias especies de ranas, que comen coquíes y aves, entre otros



June 8, 2016 10:32 AM

## Alerta de contaminación por invasión Lago Curías

La salvinia gigante prolifera en aguas con altos niveles de bacterias como enterococos y coliformes fecales.



March 31, 2016 08:02 AM

## SE BUSCA - Serpiente de Espalda Rayada

## Blogs »

July 12, 2015 11:36 AM

National Geographic realiza documental en la Isla sobre las gallinas de palo

Su población asciende los 3 millones.

April 3, 2015 10:19 AM

Detectan en Cabo Rojo la mosca del mediterráneo

Secretaría de Agricultura exhorta a no mover frutas ni vegetales de Cabo Rojo para evitar propagación de la mosca

SALLY GONZÁLEZ MIRANDA, MLA

February 23, 2015 10:35 AM

Programa Foro y Casa Abierta NISAW 2015

[more](#)

## Multimedia »



VIDEO

Entomodatos  
Sabías que...



VIDEO

Montaje y Prensa  
de Especímenes

## Especies Invasoras »



## Find us on Facebook »





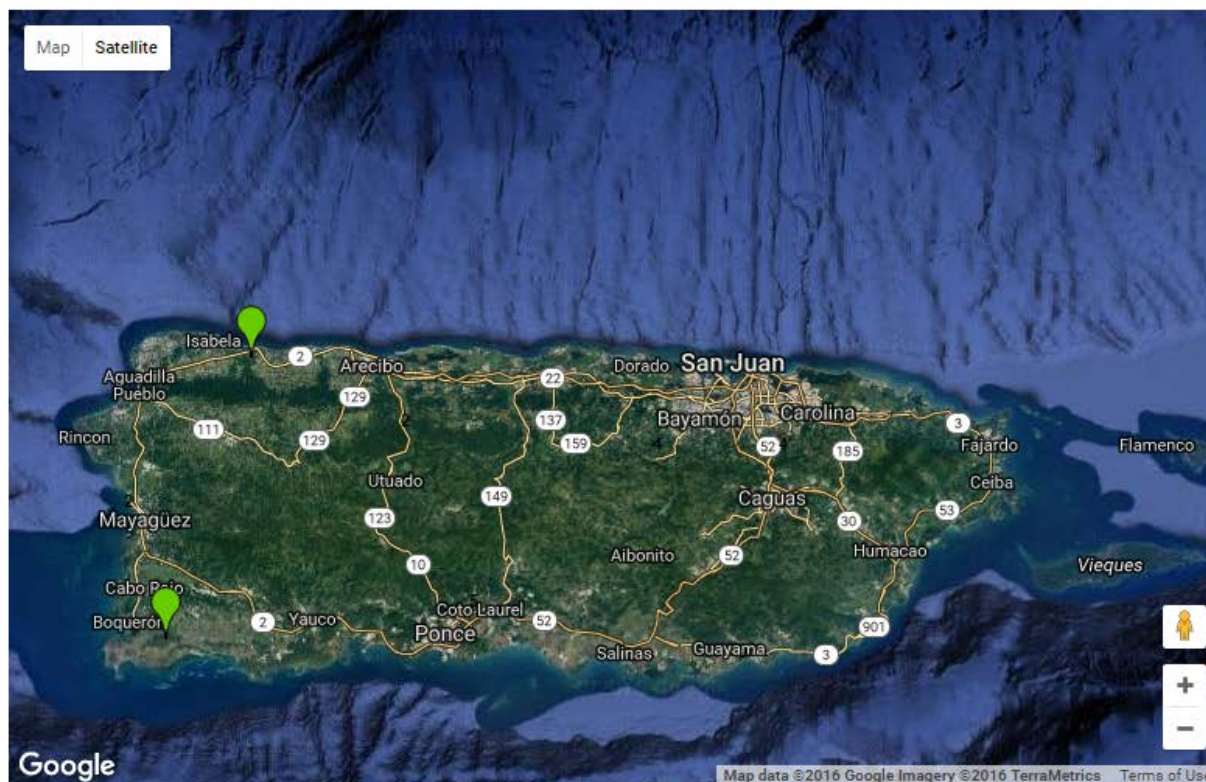
#### Mecánico:

El uso de cosechadoras puede ser efectivo para minimizar problemas extensos de jacinto de agua. Remoción manual de plantas podría ser efectivo en infestaciones pequeñas. Sin embargo, ambas técnicas son costosas, impactan grandemente la presencia de invertebrados y no limita el rebrote de nuevas infestaciones.

### Referencias

Aquatic Ecosystem Restoration Foundation (AERF) 2009. Biology and Control of Aquatic Plants: A Best Management Practices Handbook. Lyn A. Gettys, William T. Haller, and Marc Bellaud, editors. Aquatic Ecosystem Restoration Foundation, Marietta, GA.

### Mapa de Distribución



#### PRESENTE EN PR:

- Presente en Puerto Rico

# Main Results

## ■ Atlas Website

- More than 12,000 hits per year
- Mainly from PR, USA (CA), Mexico and Argentina
- Over 500 geographic coordinates of invasive species presence
- The waterhyacinth's fact sheet is the most consulted reporting 18,405 to date



# Waterhyacinth Control at Laguna San Jose: A case study



# Objectives

- In spring of 2013, a natural population of waterhyacinth present at Laguna San Jose at the San Juan Bay Estuary
- Objectives were:
  1. Determine the efficacy of mechanical and chemical control of waterhyacinth
  2. Determine its effects on water quality and aquatic insects



# Glyphosate @ 1% solution

## Rodeo®

### Herbicide

For control of annual and perennial weeds and woody plants in forests, non-crop sites, and in and around aquatic sites; also for use in wildlife habitat areas, for perennial grass release, and grass growth suppression and grazed areas on these sites.

Avoid contact of herbicide with foliage, green stems, exposed non-woody roots or fruit of crops, desirable plants and trees, because severe injury or destruction may result.

#### Active Ingredient(s):

glyphosate<sup>†</sup> N-(phosphonomethyl)glycine,

isopropylamine salt ..... 53.8%

Other Ingredients ..... 46.2%

Total Ingredients ..... 100.0%



# Assessment of Chemical Control

- Biomass and water quality were monitored before glyphosate was applied and at 48 hours, 1 week, 2 weeks, 4 weeks, and 8 weeks
- Visual estimates of % control and waterhyacinth phytotoxicity was also determined
- Aquatic insect collection was made before glyphosate treatment and at 4 and 8 months after



# Biomass collection

## 10 samples per site (T or UT)



# Assessment of Mechanical Control

- A total of 10 quadrats of 0.25 m<sup>2</sup> were collected and transported to a dry area next to the boat ramp
- Samples were collected at 7 and 14 days after mechanical removal occurred. Collected samples were weighted to determined biomass
- Aquatic fauna found tangled to waterhyacinth biomass removed was documented



# Mechanical Removal



0.25 m<sup>2</sup> quadrat



# Aquatic Insect Sampling

## 10 samples per site (T or UT)





# Water Quality Sampling

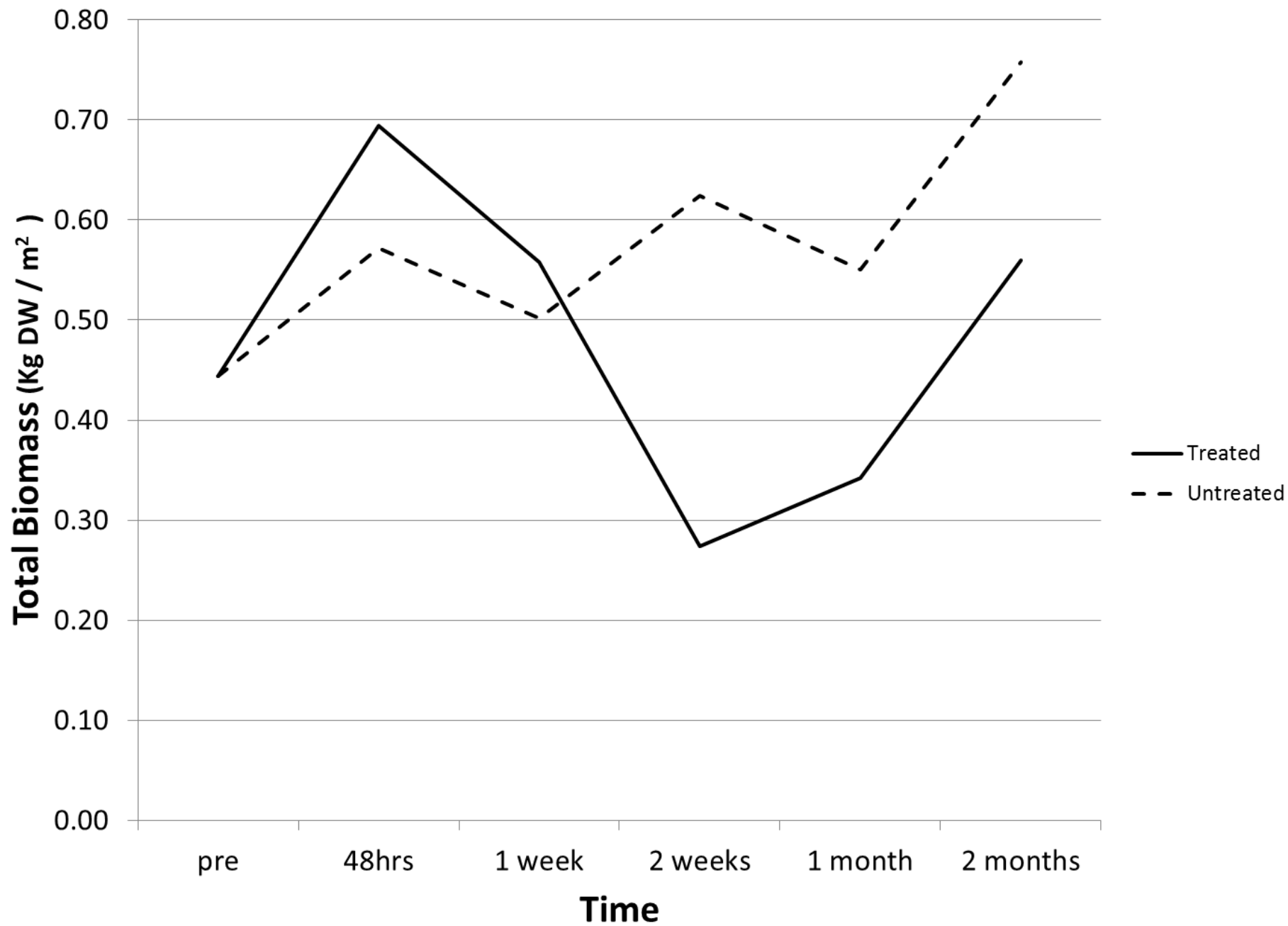
## 10 samples per site (T or UT)

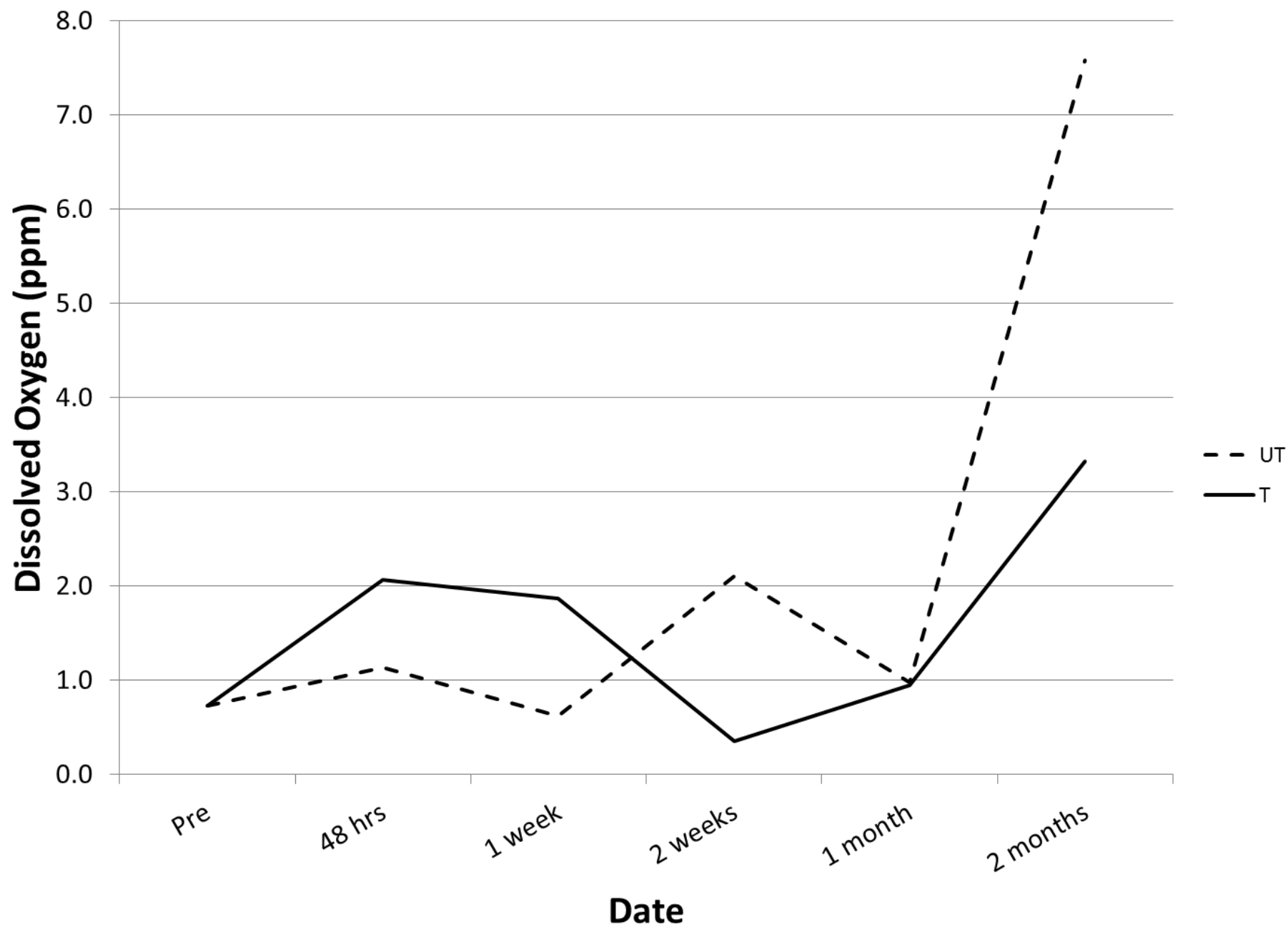


# Glyphosate effects 14 days after











# Aquatic Insects Found

Class	Order	Family	23-Feb-13	24-Mar-13	21-Apr-13
Arachnida	Araneae	Tetragnathidae	1	0	1
		Unidentified	0	8	3
Insecta	Acari	Galumnidae	25	58	26
	Collembolla	Unidentified	8	20	0
	Odonata	Coenagrionidae	3	0	1
	Orthoptera	Grillidae	1	0	0
		Unidentified	3	0	0
	Hemiptera	Belastomatidae	13	6	8
		Pleidae	45	45	40
		Mesoveliidae	48	37	9
		Veliidae	10	21	11
		Gerridae	1	4	0
		Saldidae	16	0	4
		Aphidae	1	3	0
		Unidentified	1	0	0
	Coleoptera	Noteridae	5	2	0
		Staphilinidae	2	0	0
		Scirtidae	0	0	1
		Coccinellidae	12	5	2
		Curculionidae	2	6	2
	Diptera	Culicidae	4	15	1
		Chironomidae	23	37	9
		Stratiomydae	1	0	0
		Syrphidae	0	12	2
		Ephydriidae	0	4	0
		Muscidae	1	0	0
		Unidentified	0	0	1
	Trichoptera	Unidentified	0	1	0
	Lepidoptera	Pyalidae	1	1	0
	Hymenoptera	Formicidae	5	19	6

# Aquatic Fauna Found within Waterhyacinth





# Resources at the AES, UPRM

## Mesocosm Research Facility, AES Isabela



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- Colaborators: Drs. John D. Madsen and Victor Maddox from Mississippi State University





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