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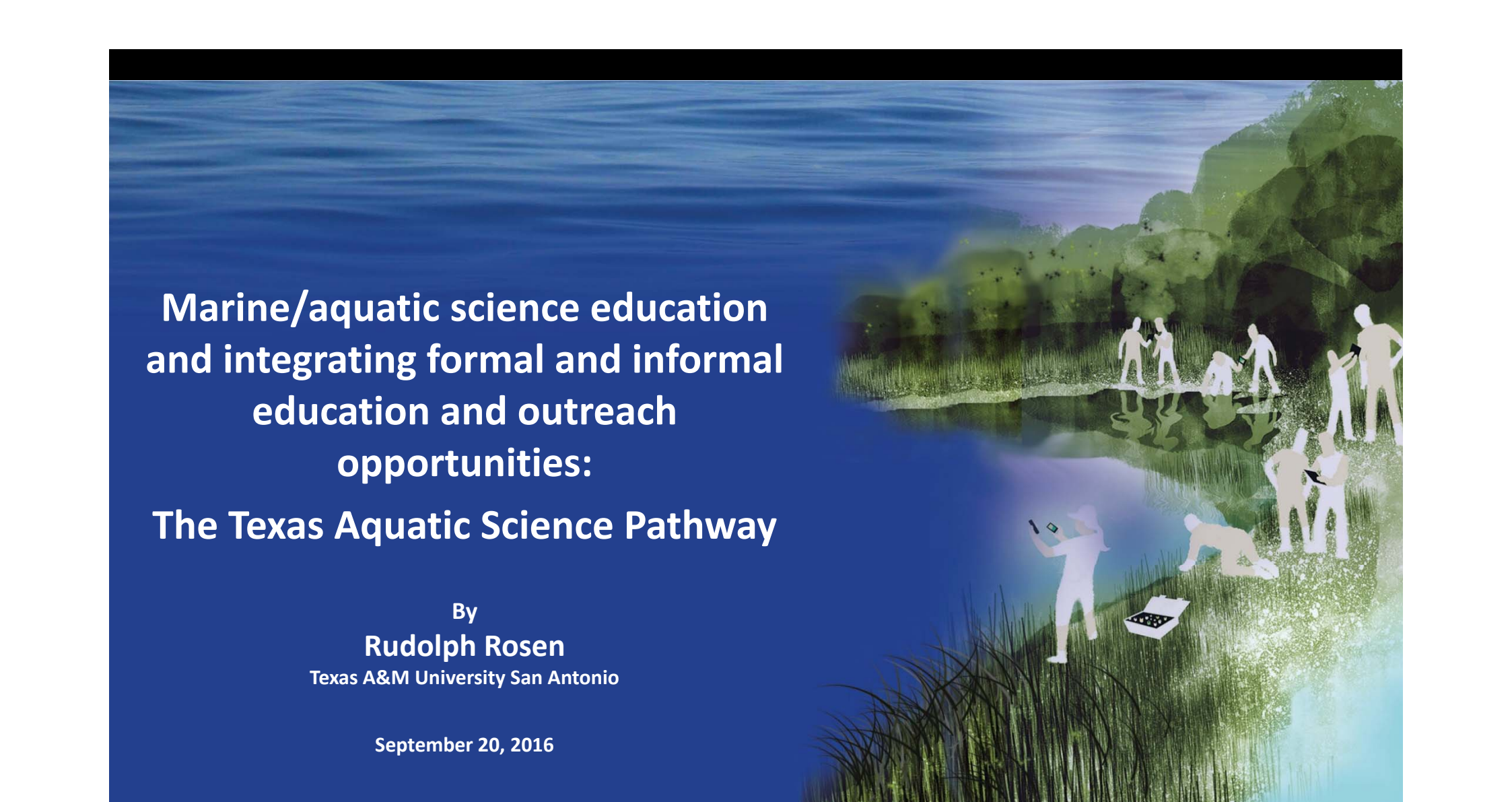
Marine/Aquatic Science Education and Integrating Formal and Informal Education and Outreach Opportunities

Rudolph A. Rosen

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**Marine/aquatic science education
and integrating formal and informal
education and outreach
opportunities:
The Texas Aquatic Science Pathway**

By
Rudolph Rosen
Texas A&M University San Antonio

September 20, 2016



**THE MEADOWS CENTER
FOR WATER AND THE ENVIRONMENT**



CE³SAR



**TEXAS A&M
UNIVERSITY
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**HARTE
RESEARCH INSTITUTE
FOR GULF OF MEXICO STUDIES**

**TEXAS
PARKS &
WILDLIFE**

From headwaters to the ocean, H2O has developed methods and technology enhancements to help today's students become tomorrow's engaged citizens who understand and advocate the environmental, economic and societal values of water.



H2O

Headwaters to Ocean

Funded by a generous grant from the
Ewing Hasell Foundation

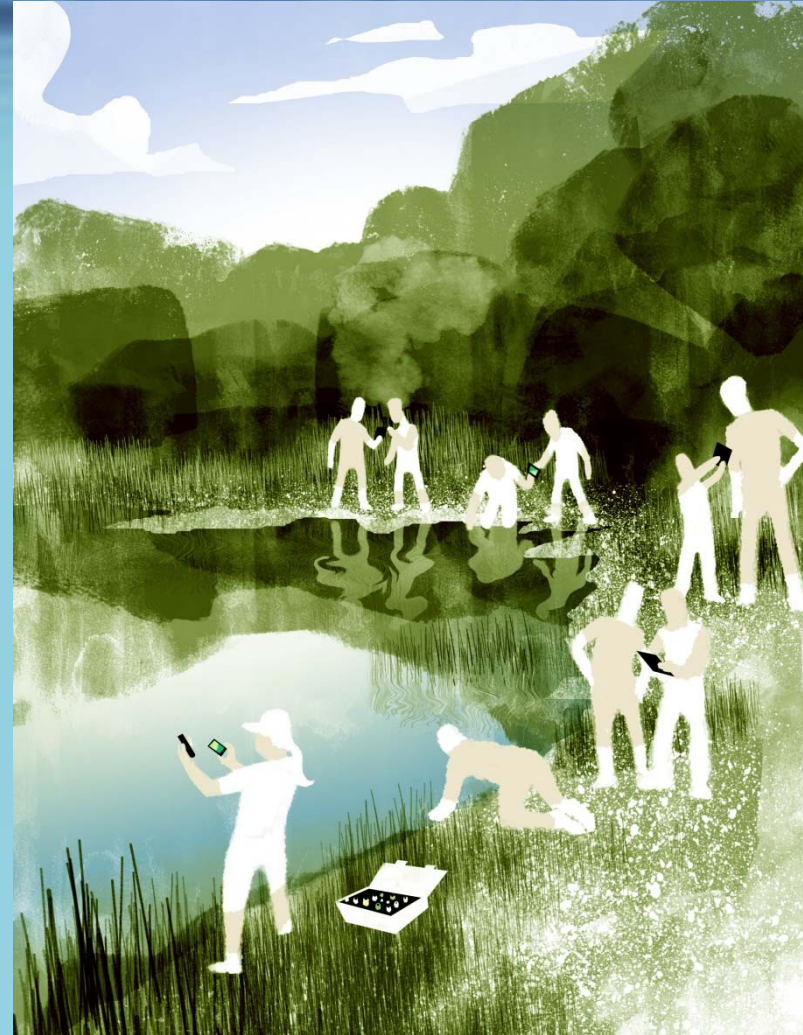


THE MEADOWS CENTER
FOR WATER AND THE ENVIRONMENT
TEXAS STATE UNIVERSITY



TEXAS A&M
UNIVERSITY
CORPUS
CHRISTI | HARTE
RESEARCH INSTITUTE
FOR GULF OF MEXICO STUDIES

- Virtual Water Experience
- Tech Equipped Bay and Estuary Experience
- Watershed Technology Safari

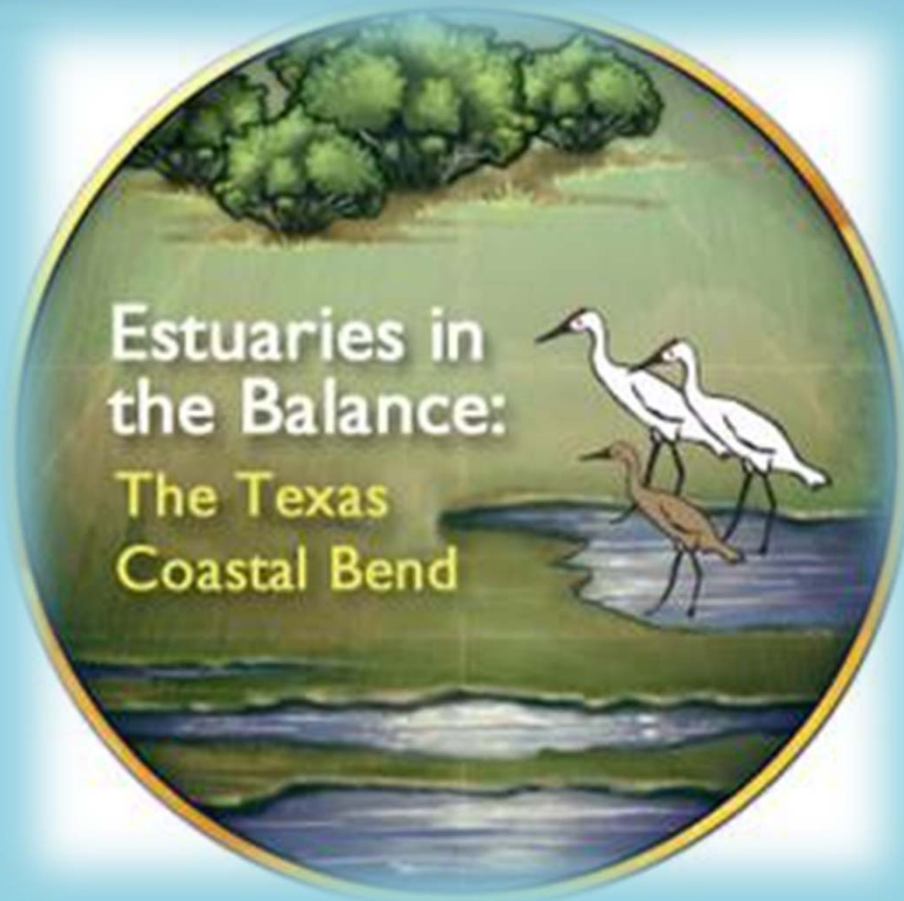


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Headwaters to Ocean



Web-Based Interactive Learning



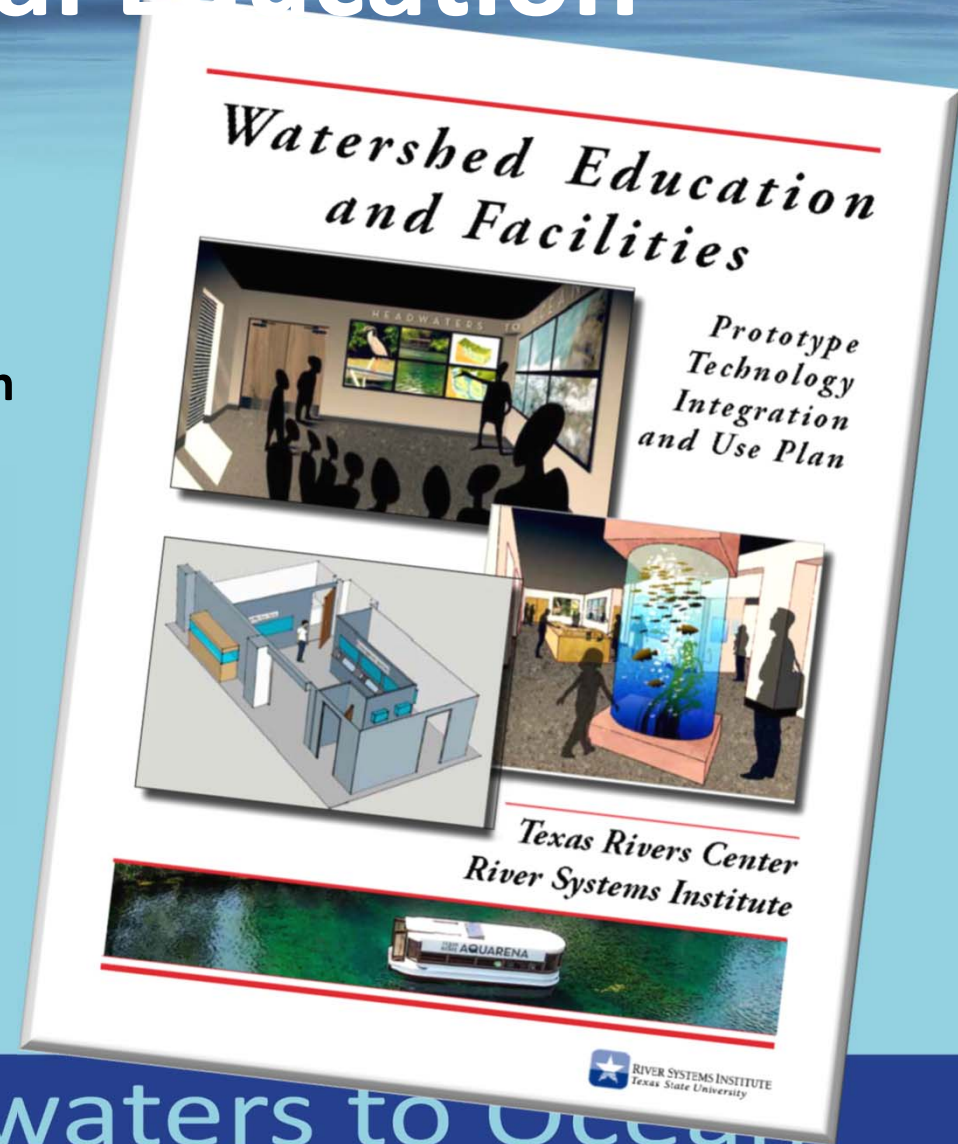
ESTUARIES IN THE BALANCE: THE TEXAS COASTAL BEND

- Interactive multimedia focused on estuary ecosystems
- Games, videos, dynamic visualizations.

High-Tech Integration in Experiential Education

Prototype Technology Integration and Use

- Technology integration and research test bed
- Accommodate :
 - 17,500 K-12 students in class groups
 - 125,000 children and adults unguided



High-Tech Integration in Experiential Education

Experiential Learning Laboratory - Technology Test Bed

- Multi-media, multi-screen array
- Linked 22-screen array
- Outdoor Wi-Fi network
- Interactive touch table
- Interactive kiosks
- Low-cost design
- Low-tech programming
- **DEMO OUTDOOR CTRS**
- **EASILY EXPORTED**
- **RESEARCH PLATFORM**



Headwaters to Ocean

High-Tech Integration in Experiential Education

- iPad – iPhone for outdoor aquatic science instruction

- Species ID Key
- GPS Photo Scavenger Hunt
- Journaling
- Social-Network Ready
- Games
- Teacher-Friendly,
- QR Code Scanner
- Documents,
- Videos
- Photos
- Links

Adaptable for outdoor learning ctrs



Headwaters to Ocean

Research – Ph.D. Dissertation

Conclusions

–Experiential water education can be enhanced by:

- interactive technology
- direct contact with water
- linking a water experience in one location to other water locations



Headwaters to Ocean

Opps!

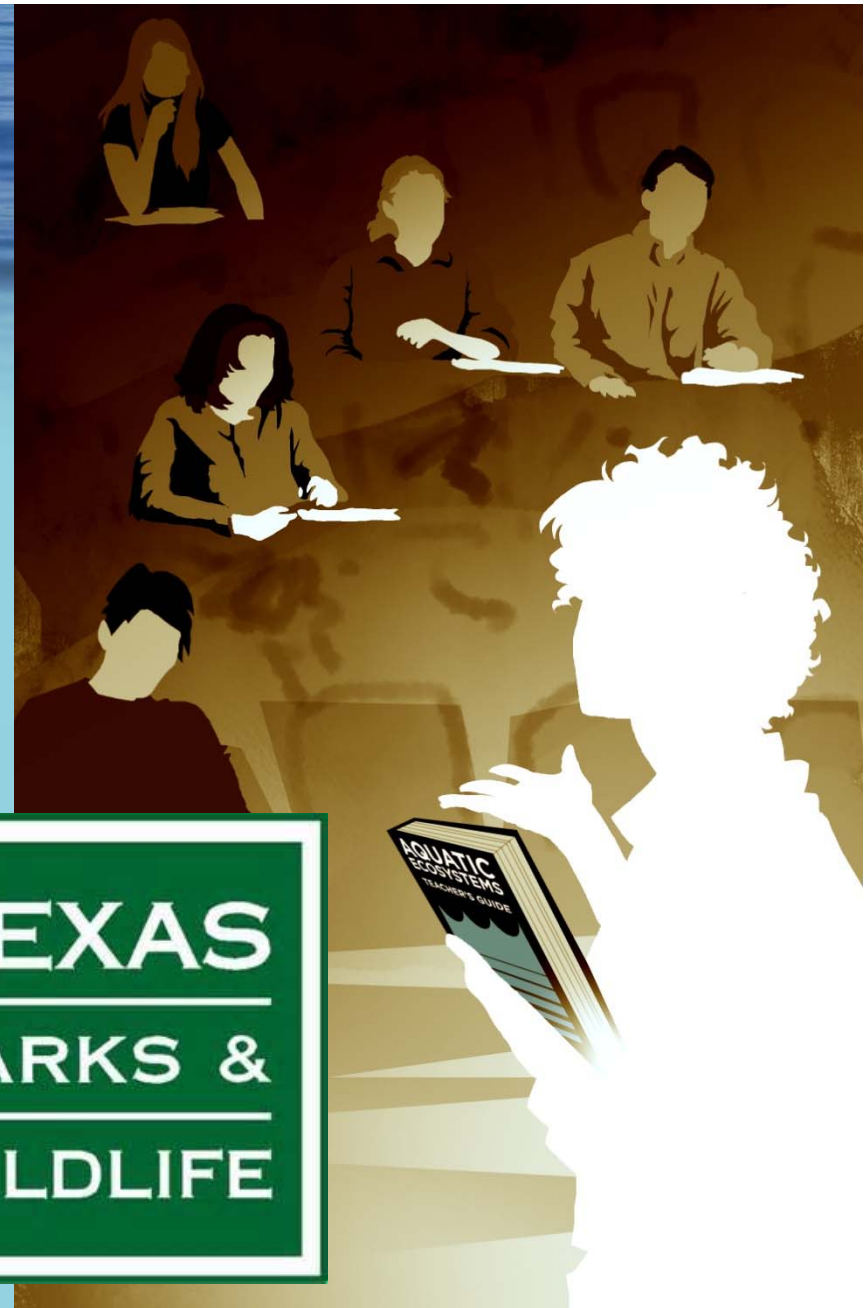


- **Cool apps, games, interactives and even bigger ideas.....all with no context for use by teachers.**
- **Loser! Loser!**

Effective Pathway for Water Curricula

Texas Aquatic Science

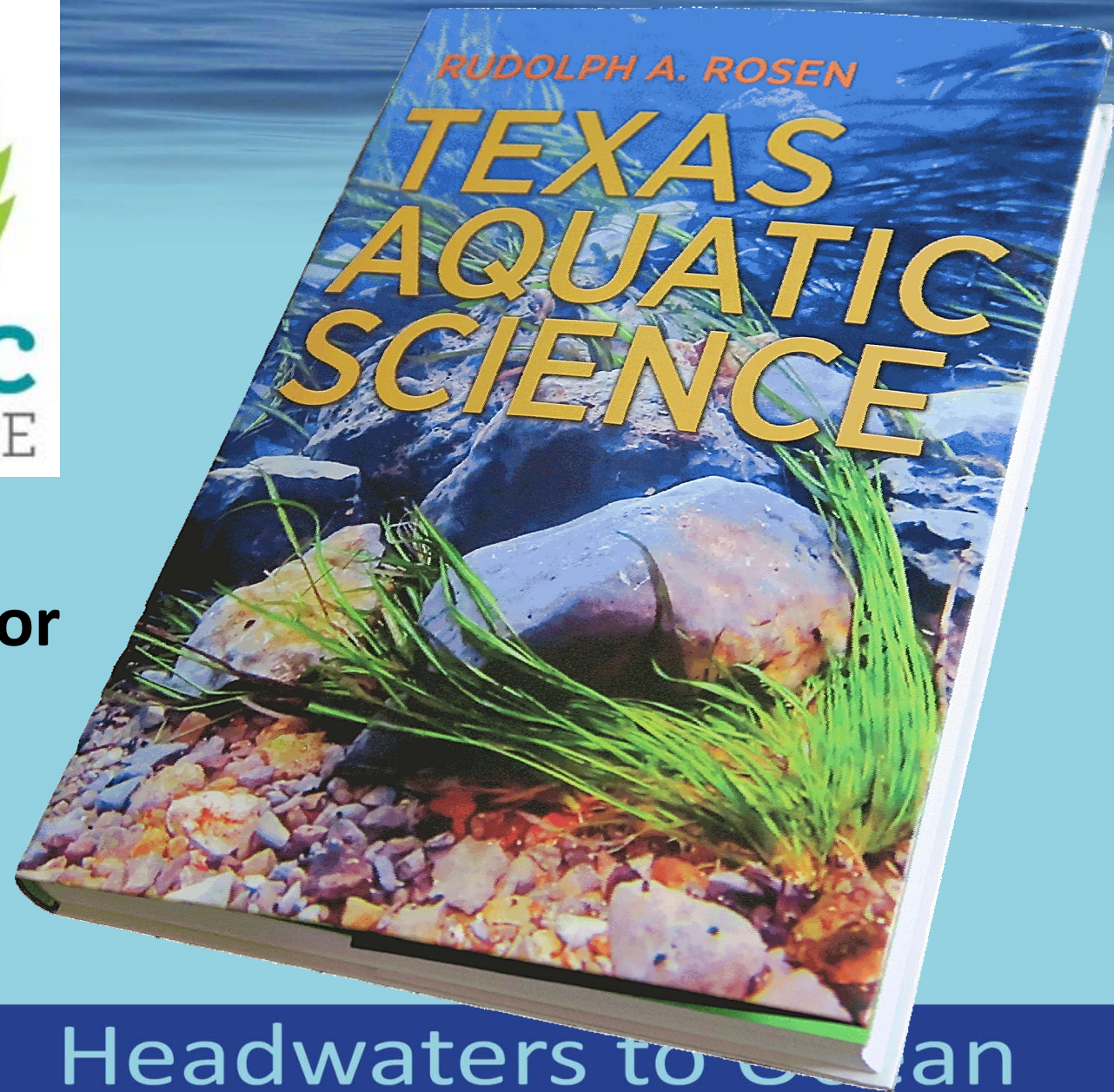
- Texas' first comprehensive curricula in Aquatic Science for middle and high schools students
- Meeting all state standards for education
- **#1 Internet ranked curriculum for aquatic science**



Headwaters to Ocean



**Foundation for
Instruction**



Headwaters to Ocean

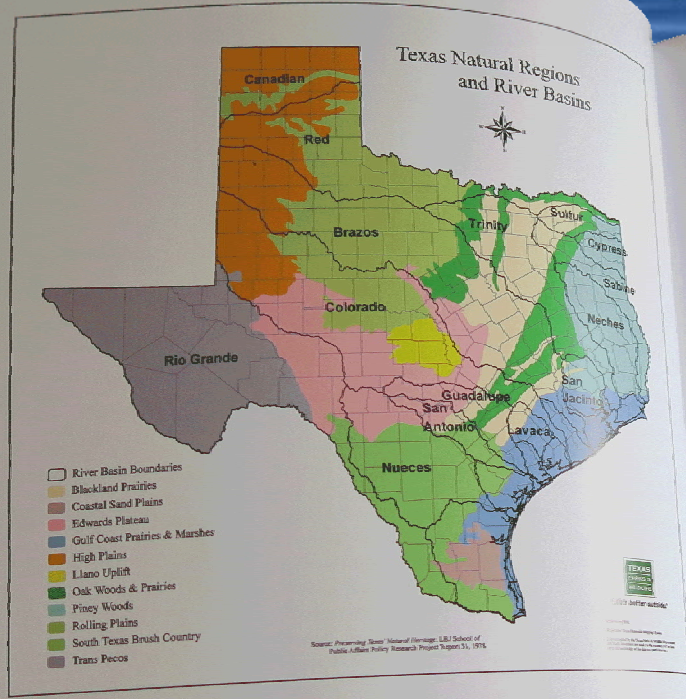


Figure 3.5. Texas natural regions and river basins. Map courtesy of Texas Parks and Wildlife Department.

quantity in the watersheds. Each region has different kinds of habitat for wildlife and opportunities for people (fig. 3.6). Every stream, lake, or wetland is a reflection of its watershed. The goal of the Clean Water Act is water that is "drinkable, swimmable and fishable." Natural resource agencies, communities, and individuals work together for good water quality and quantity. Knowing our watershed and its relationship to surrounding watersheds can help us conserve our aquatic resources.

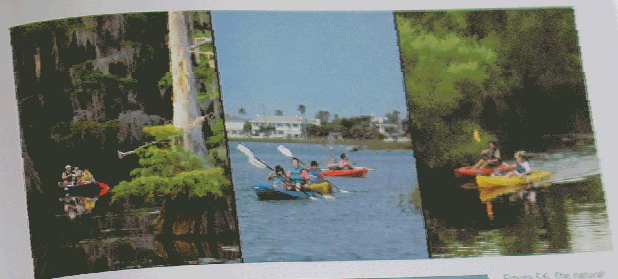
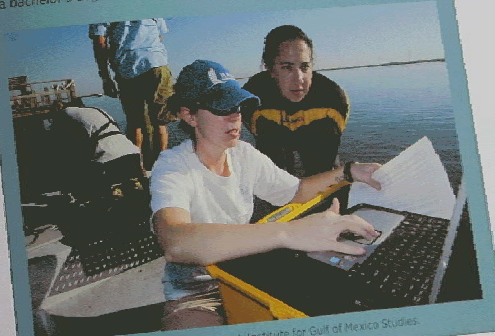


Figure 3.6. The natural physiographic regions in Texas can provide very different boating and fishing experiences. Canoeing in East Texas (left), paddling in Arenas Bay near Rockport (center), and kayaking at Parke Holmes Ranch on the Lampasas River near Killeen (right). Photographs courtesy of Texas Parks and Wildlife Department.

AQUATIC SCIENCE CAREER

Hydrologist
 Hydrologists study the movement, distribution, and quality of water. They test, measure, and collect water data, such as river flow rate, tidal fluctuations, dissolved oxygen, sediment load, acidity, salinity, and groundwater levels. These data help us learn about the oceans, surface water on land, and groundwater in our aquifers. Hydrologists write reports, prepare water maps, tables, and graphs of study results, and perform data analyses. These are published in documents or scientific journals and can be used to support water projects or investigations. Hydrologists have at least a bachelor's degree; many have a master's or doctorate degree.



Photograph courtesy of Harri Research Institute for Gulf of Mexico Studies.

THE CONNECTION BETWEEN SEAWEED, JELLYFISH, AND BEACH TRASH IN TEXAS

Beachgoers in Texas often remember encounters with seaweed, jellyfish, and trash found on the beach. Believe it or not, all three are frequent features of Gulf Coast beaches for the same reason. All are carried along by currents and winds that push them onto Texas beaches. Massive currents swirl about in the giant basin that is the Gulf. As happens when you stir liquid contents in a big bowl, the water in the Gulf moves in a definite direction. This water movement, or current, carries along with it whatever floats in the water. Currents in the Gulf move toward Texas from both the north and south. The currents combine with winds that blow toward Texas. This helps push animal passengers as well as any floating trash or seaweed onto our beaches.

At times Texas beaches may contain a large amount of sargassum, a brown seaweed. Although it may look and smell yucky, this seaweed actually helps build up the beach by acting to hold sand in place. Jellyfish are another passenger in the currents' continuous journey because they are free-floating animals. While some species of jellyfish can give swimmers an unpleasant sting, trash gives everyone an unpleasant experience.

Jellyfish and seaweed are a natural part of the Gulf ecosystem, but the trash is not. Where does trash come from? It comes from all over the Gulf, from other states, from Mexico, from storm sewers that empty into the Gulf, and from the rivers draining into the Gulf, such as the Mississippi River. It comes from ships and oil and gas platforms far out in Gulf waters. It floats northward to Texas from Mexico and southward from Louisiana. The amount of trash that washes to shore is enormous. Sometimes sea turtles and other species that eat jellyfish mistake clear plastic bags or other trash in the water for food and eat the trash. This can cause injury or death because the plastic clogs up the animals' stomachs and intestines.

Every year more than 1,000 people volunteer to pick up over 150 tons of trash on Padre Island. Volunteers also clean up other beaches. When you go to the beach, remember to pick up your own trash. You may also want to join others at your favorite beach on volunteer cleanup days or just do it yourself.



Map courtesy of Marine Research Institute for Gulf of Mexico Studies and modified by National Oceanic and Atmospheric Administration (NOAA) (photograph by Rudolph Brown) (middle photograph courtesy of Corpus Christi Caller-Times (online))



Texas Aquatic Science

Teacher Guide

- **Science investigations, games, cooperative learning activities, Internet projects, readings, videos, science journals, field based student research projects, tests and assessments.**

TEXAS AQUATIC SCIENCE

*From Molecules to Ecosystems,
and Headwaters to Ocean*

**Teacher Guide to Aquatic Science and Ecosystems Curriculum
for Middle School and High School**

A joint project
Texas Parks and Wildlife Department
The Meadows Center for Water and the Environment, Texas State University
Harte Research Institute for Gulf of Mexico Studies, Texas A&M University - Corpus Christi



Headwaters to Ocean

Texas Aquatic Science Videos



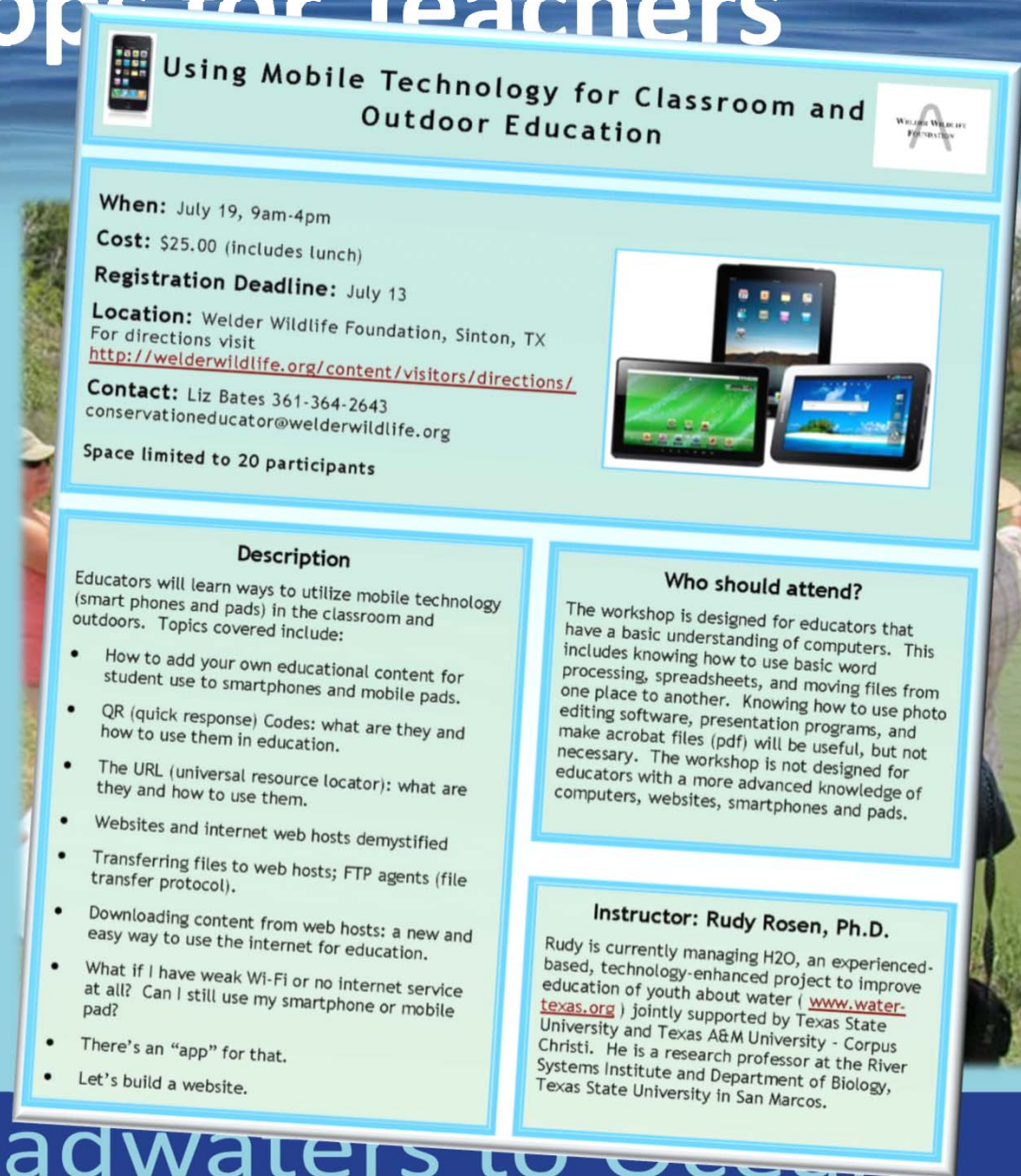
America's Sea: The Gulf of Mexico



Headwaters to Ocean

Workshops for Teachers

- Instruction for teachers on how to use Texas Aquatic Science:
 - Teachers Guide
 - Exercises
 - Integrating new mobile technology into outdoor and classroom education



Using Mobile Technology for Classroom and Outdoor Education

When: July 19, 9am-4pm
Cost: \$25.00 (includes lunch)
Registration Deadline: July 13
Location: Welder Wildlife Foundation, Sinton, TX
For directions visit <http://welderwildlife.org/content/visitors/directions/>
Contact: Liz Bates 361-364-2643
conservationeducator@welderwildlife.org
Space limited to 20 participants

Description

Educators will learn ways to utilize mobile technology (smart phones and pads) in the classroom and outdoors. Topics covered include:

- How to add your own educational content for student use to smartphones and mobile pads.
- QR (quick response) Codes: what are they and how to use them in education.
- The URL (universal resource locator): what are they and how to use them.
- Websites and internet web hosts demystified
- Transferring files to web hosts; FTP agents (file transfer protocol).
- Downloading content from web hosts: a new and easy way to use the internet for education.
- What if I have weak Wi-Fi or no internet service at all? Can I still use my smartphone or mobile pad?
- There's an "app" for that.
- Let's build a website.

Who should attend?

The workshop is designed for educators that have a basic understanding of computers. This includes knowing how to use basic word processing, spreadsheets, and moving files from one place to another. Knowing how to use photo editing software, presentation programs, and make acrobat files (pdf) will be useful, but not necessary. The workshop is not designed for educators with a more advanced knowledge of computers, websites, smartphones and pads.

Instructor: Rudy Rosen, Ph.D.

Rudy is currently managing H2O, an experienced-based, technology-enhanced project to improve education of youth about water (www.water-texas.org) jointly supported by Texas State University and Texas A&M University - Corpus Christi. He is a research professor at the River Systems Institute and Department of Biology, Texas State University in San Marcos.

Texas Aquatic Science

A guide for students -- From molecules to ecosystems, and headwaters to ocean

Home Chapters Glossary



Learn about Texas Aquatic Ecosystems from Headwaters to Ocean

00000000



Texas Aquatic Science Chapters



Water is Life -- Chapter 1



The Ultimate Recyclable Water -- Chapter 2



What's Your Watershed Address? -- Chapter 3



Living in Water -- Chapter 4



From Sun to Sunfish -- Chapter 5



Texas Aquatic Ecosystems -- Chapter 6



Aquifers and Springs -- Chapter 7



Streams and Rivers -- Chapter 8



Lakes and Ponds -- Chapter 9



Wetlands -- Chapter 10



Bays and Estuaries -- Chapter 11



Oceans: The Gulf of Mexico -- Chapter 12



Fishing for Conservation -- Chapter 13



Water for People and the Environment -- Chapter 14

Working and Careers in Water and Aquatic Science



Health Ecologist



Conservation Officer



Educator



Environmental Protection Worker



Fish Hatchery Biologist

Texas Aquatic Science Online

• texasaquaticscience.org

- Chapters
- Videos
- Career Promotions
- Science stories
- How to help

Headwaters to Ocean

Texas Aquatic Science Online University Course



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Oceans: Gulf of Mexico - Lesson 12 (Closed Captioned) +
Aquatic Science with Dr Rudy Rosen - Closed Captioned · 1/7 videos

Oceans: Gulf of Mexico Summary Overview - L12.0 CCE
Aquatic Science with Dr Rudy Rosen - Closed Captioned

Oceans: Gulf of Mexico Introduction - L12.1 CCE
Aquatic Science with Dr Rudy Rosen - Closed Captioned

Gulf of Mexico - L12.2 CCE
Aquatic Science with Dr Rudy Rosen - Closed Captioned

Seashore - L12.3 CCE
Aquatic Science with Dr Rudy Rosen - Closed Captioned

Gulf of Mexico Life - L12.4 CCE
Aquatic Science with Dr Rudy Rosen - Closed Captioned

Gulf of Mexico Sustainability - L12.5 CCE
Aquatic Science with Dr Rudy Rosen - Closed Captioned

Oceans: Gulf of Mexico



Aquatic Science with Dr Rudy Rosen



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Gulf of Mexico Life - L12.4 CCE

Aquatic Science with Dr Rudy Rosen - Closed Captioned · 25 views

Gulf of Mexico - L12.2 CCE

Aquatic Science with Dr Rudy Rosen - Closed Captioned · 198 views

8:43

Published on Apr 18, 2015

Oceans: Gulf of Mexico Summary Overview, from Aquatic Science STEM curriculum Lesson 12 (Oceans: The Gulf of Mexico) closed captioned in English that includes topics: Which states share Gulf waters? Which other countries share the Gulf? What are some of the industries in the



Headwaters to Ocean

Texas Aquatic Science Online

225 videos – Closed Captioned

Aquatic Science Videos

Home Videos Closed Captioned

AQUATIC & WATER SCIENCE VIDEOS

SCIENCE LESSONS WITH DR. RUDY ROSEN FROM TEXAS AQUATIC SCIENCE

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Category: Ecology
Language: English
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Links

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Description

The Texas Aquatic Science series explores our state's ecosystems from headwaters to ocean. Find teaching materials and more resources at <http://texasaquaticscience.org/>. For grades 6–12.

Name	Description	Released	Price
1 Chapter 1. Water is Life	Water has properties t...	11/6/2013	Free
2 Chapter 2. The Ultima...	The earth's water is on...	11/6/2013	Free
3 Chapter 3. What's You...	Everyone lives in a wat...	11/6/2013	Free
4 Chapter 4. Living in W...	All aquatic species, inc...	11/6/2013	Free
5 Chapter 5. From Sun t...	Aquatic habitats are c...	11/6/2013	Free
6 Chapter 6. Texas Aqu...	Ecosystems are compl...	11/6/2013	Free
7 Chapter 7. Aquifers a...	Springs have attracted...	11/6/2013	Free
8 Chapter 8. Streams an...	Texas streams and riv...	11/6/2013	Free
9 Chapter 9. Lakes and ...	Lakes and ponds provi...	11/6/2013	Free
10 Chapter 10. Wetlands	Wetlands are among t...	11/6/2013	Free
11 Chapter 11. Estuaries ...	Texas bays and estuar...	11/6/2013	Free
12 Chapter 12. Oceans: T...	The Gulf of Mexico is ...	11/6/2013	Free
13 Chapter 13. Fishing fo...	Understanding fish an...	11/6/2013	Free
14 Chapter 14. Water for ...	One of the greatest ch...	11/6/2013	Free

14 Items

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Texas Aquatic Science Online



Rudolph Rosen

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University > Natural Sciences > Aquatic Science

Aquatic Science

<p>Oceans Glossary - Aquatic Science with Dr. Rudy Rosen 12.7</p>	<p>Lakes and Ponds Intro - Aquatic Science with Dr. Rudy Rosen 9.2</p>	<p>Freshwater Inflow - Aquatic Science with Dr. Rudy Rosen 11.4</p>
<p>Food Chain - Aquatic Science with Dr. Rudy Rosen 5.7</p>	<p>Survival - Aquatic Science with Dr. Rudy Rosen 5.9</p>	<p>Bays and Estuaries Overview - Aquatic Science with Dr. Rudy Rosen 11.1</p>
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<p>Water Erosion - Aquatic Science with Dr. Rudy Rosen 3.6</p>	<p>Invertebrates - Aquatic Science with Dr. Rudy Rosen 4.10</p>	<p>Water Use - Aquatic Science with Dr. Rudy Rosen 1.5</p>
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Aquatic Science

Microbiology 4 Leeuwenhoek 2 Microbes 3 Classification 2

Teachers



Rudolph Rosen

Professor
Austin, Texas, United States of A...



Headwaters to Ocean

Interconnected Curriculum



Headwater

Texas Aquatic Science

A guide for students from molecules to ecosystems, and headwaters to ocean

Home Chapters Glossary

You Can Make a Difference



Do you believe that everyone deserves a sustainable and adequate supply of clean, safe water for our homes, farms, and industries? Do you believe fish, wildlife, and all other aquatic life need an adequate supply of clean water, too?

If so, you can help ensure this happens in Texas. Here are ways you can help make a difference, as a student and as an adult. You may be able to think of other ways to help where you live.

- Learn where your drinking water comes from and tell others.
- Become a volunteer water quality monitor through the Texas Stream Team or, have your entire class monitor water quality (see sidebar on Stream Team)
- Learn about water conservation measures you can take and ways you can reduce pollution where you live.
- Help rescue stranded marine mammals, for example, volunteer through the Texas Marine Mammal Stranding Network.

Texas Aquatic Science Certified Field Sites



- **Connect aquatic science in the classroom with educators and outdoors learning**
- **65 sites (so far)**

Effectiveness Research



- 2015-16 School Year
- 160 Teachers Trained for Pilot
- 4,500 Students in Pilot Study
- 39 Schools



Headwaters to Ocean

Effectiveness Research - Results



- **Teachers heavily rely on materials for instruction...**
 - strong preference for using combination of printed and online
 - high percentage indicated effective curriculum
 - effective in enhancing student learning about water



Headwaters to Ocean

Effectiveness Research - Results

- **Statistics show patterns of website use:**
 - heavy use when class is in session
- **About 220,000 unique individuals visited the website in the 2015-16 school year, the first full year of classroom use.**



Headwaters to Ocean

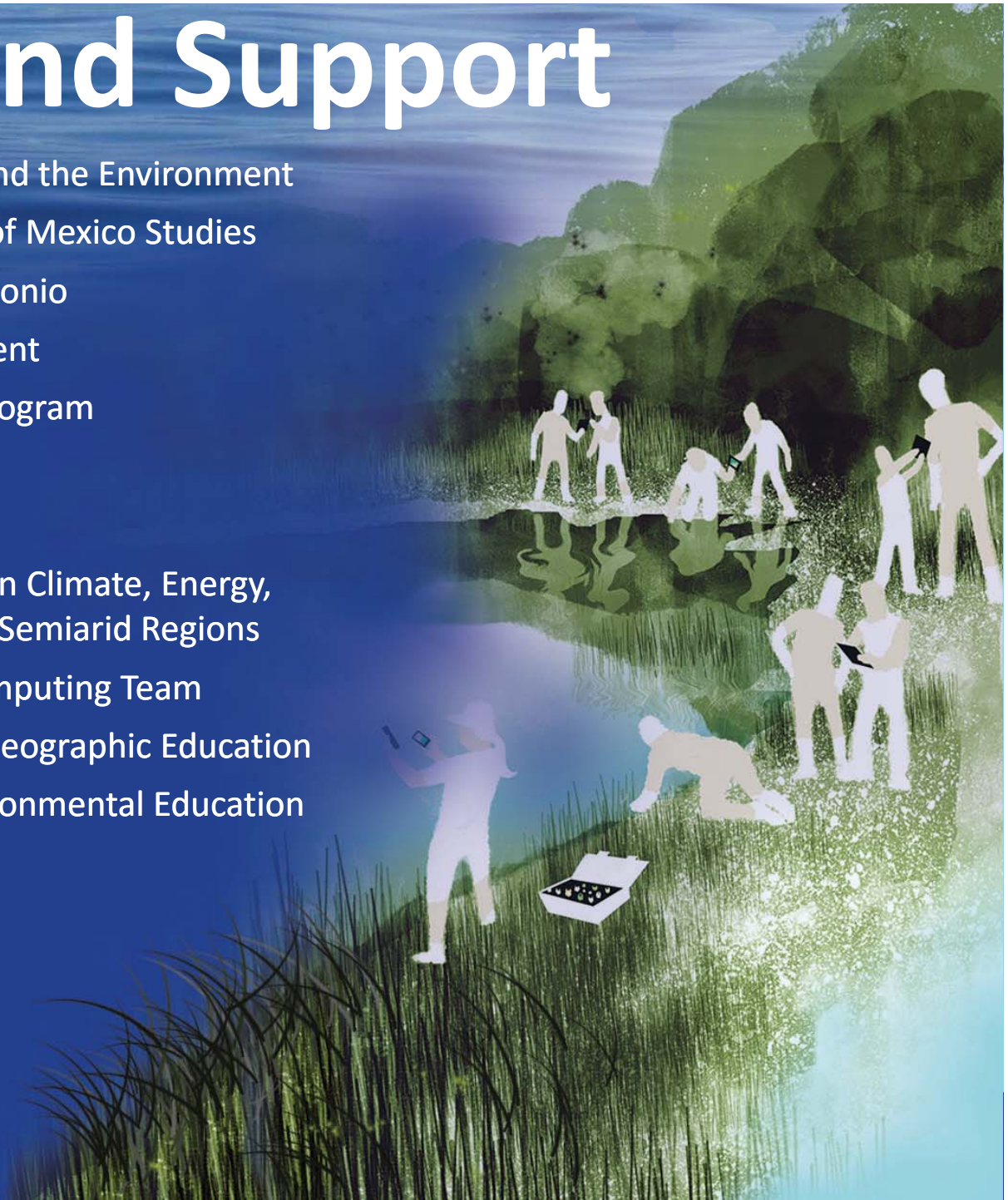
Points of Discussion

1. “Apps” alone may not be effective
2. Teachers need context to teach
3. It's no simple matter
 1. Time
 2. Money
 3. Diverse APPLIED Skills



Partners and Support

- The Meadows Center for Water and the Environment
- Harte Research Institute for Gulf of Mexico Studies
- Ewing Halsell Foundation, San Antonio
- Texas Parks and Wildlife Department
- USFWS - Sport Fish Restoration Program
- National Science Foundation
- The Meadows Foundation
- Research Coordination Network on Climate, Energy, Environment, and Engagement in Semiarid Regions
- Texas State High Performance Computing Team
- Gilbert M. Grosvenor Center for Geographic Education
- Hamline Univ. Ctr. for Global Environmental Education
- Texas State Aquarium
- Texas Pioneer Foundation
- International Crane Foundation
- Gary Jobs Corps
- Welder Wildlife Foundation
- Texas Stream Team



Texas Aquatic Science Videos



America's Sea: The Gulf of Mexico



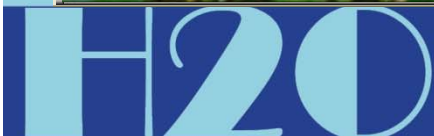
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AQUATIC COMMUNITIES

INTRODUCTION



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