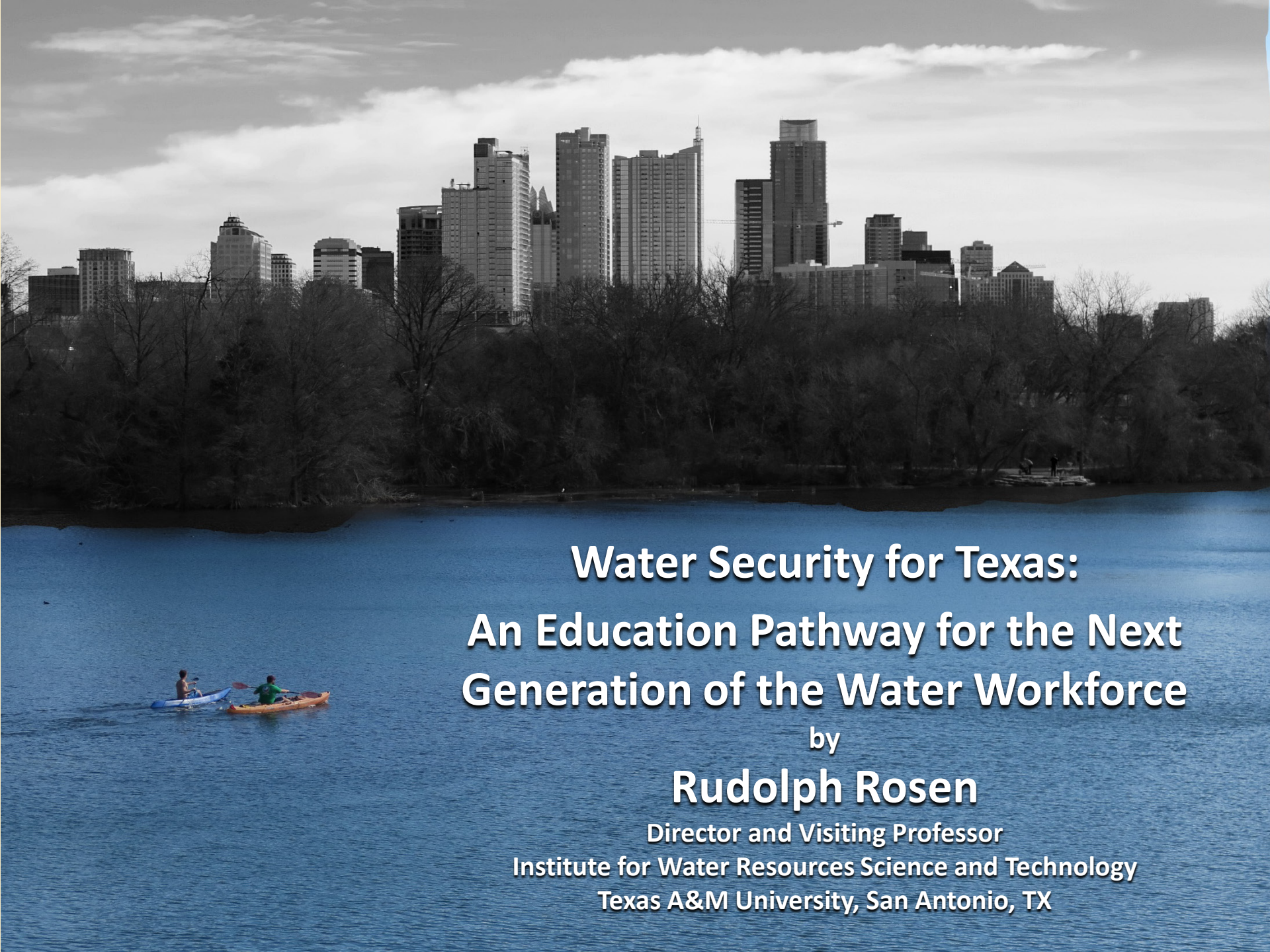
2019

Water Security for Texas: A Post-Secondary Education Pathway for Water Workforce Readiness

Rudolph A. Rosen



Water Security for Texas:

An Education Pathway for the Next Generation of the Water Workforce

by

Rudolph Rosen

Director and Visiting Professor

Institute for Water Resources Science and Technology

Texas A&M University, San Antonio, TX

EXPERTS EXPRESS ALARM - Nationwide

"We are facing difficulty recruiting, training, and retaining employees, especially for small systems."

- American Water Works Association's annual ***State of the Water Industry Report:***
  - 2014 to 2017: only 1% of respondents indicated the industry is fully prepared to address workforce losses and recruitment needs in the next 5 years.
  - Retirement eligibility may be as high as 50% of the entire workforce within 10 years
  - Additional 45% increase in recruitment of water workers is needed.

JANUARY 2018

1. United States Government Accountability Office (GAO) released a report on water workforce readiness
2. Senate bill 2346 introduced
   - To establish a water infrastructure workforce development program

GAO REPORT SENATE BILL 2346

- There is industry-wide concern about filling jobs.
  - Management of water utilities and to ensure safe drinking water and long-term sustainability.
  - Compliance with the Safe Drinking Water Act and Clean Water Act
- Median age of water sector workers is 48 years…..6 years older than the national median age of all workers.
- Unprecedented workforce replacement needs:
  - 37% of water and 31 % of wastewater workers will retire over the next 10 years.

TEXAS EXPERTS EXPRESS ALARM

Texas water experts met in a series of planning forums in 2015 and 2016. They identified concern about the water workforce.

- A coming wave of retirements and attrition.
- Inadequate recruitment.
- A general failure of post-secondary educational institutions to supply workforce ready graduates for Texas' urban and rural water sectors.
- **Participants listed ideas for solution**

WATER WORKFORCE EDUCATION

Recommendations included:

- Mentoring
- Internships
- Increased access to industry training programs
- Create more effective, flexible, and job-relevant pathways to higher education:
  - Increase recognition and attractiveness of water jobs
  - Job-relevant workforce-ready training
  - Degree programs that will enable long-term professional growth for water workers

START AT THE BEGINNING

Attracting the Next Generation of Water Workers

Create a pathway for water education from middle through high school:

- Teacher training
- Student instructional materials
- Experiential education

Introduce students to jobs in water

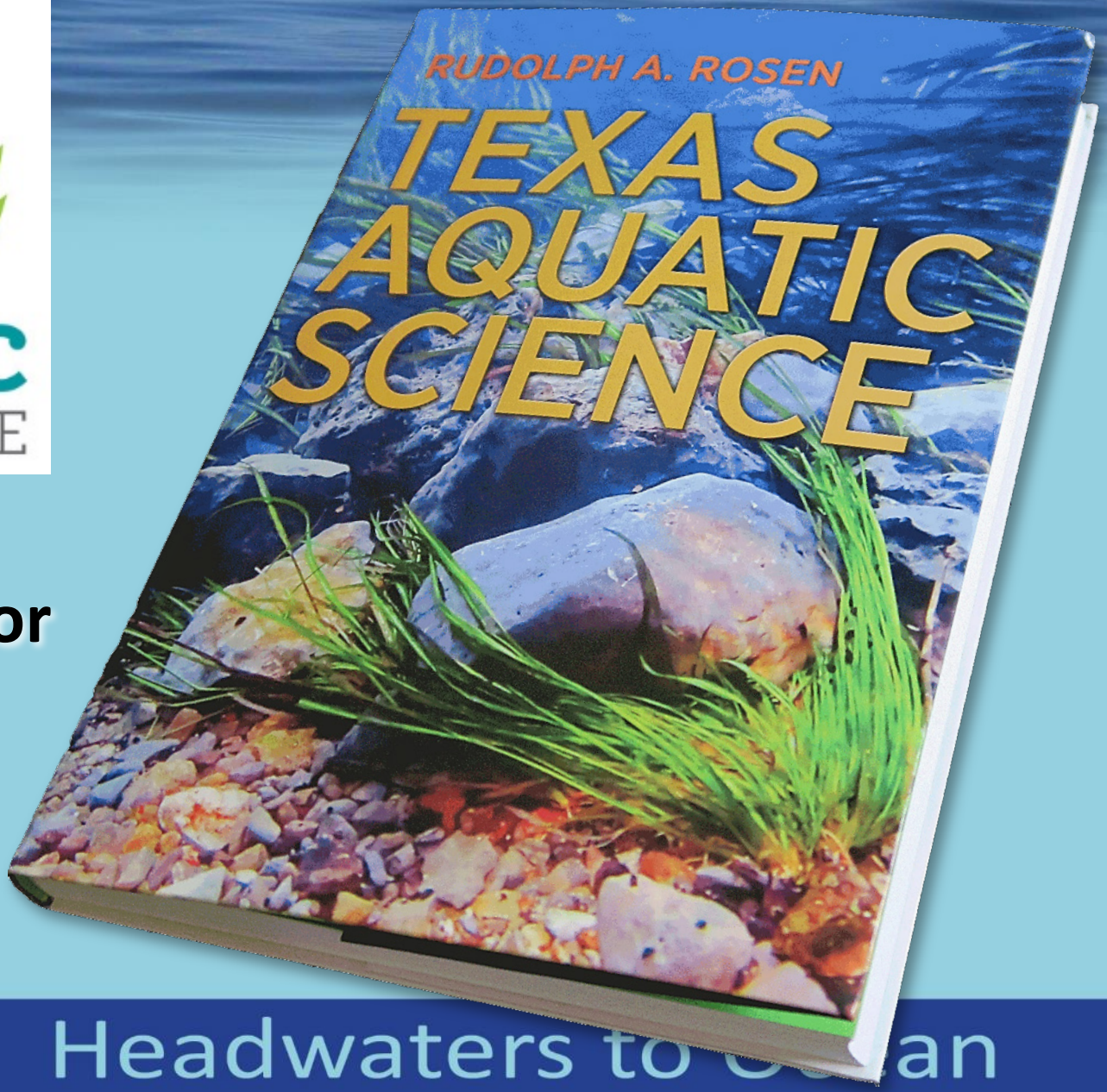
Effective Pathway for Water Curricula

Texas Aquatic Science

- **Texas' first comprehensive curricula in water for middle and high schools students**
- **Meeting all state standards for education (**Texas Essential Knowledge and Skills – TEKS)
  - **–Water standards in Aquatic Science and Environmental Systems**
- **#1 Internet ranked curriculum for aquatic science**

Texas AQUATIC SCIENCE

Foundation for Instruction



H2O Headwaters to Ocean

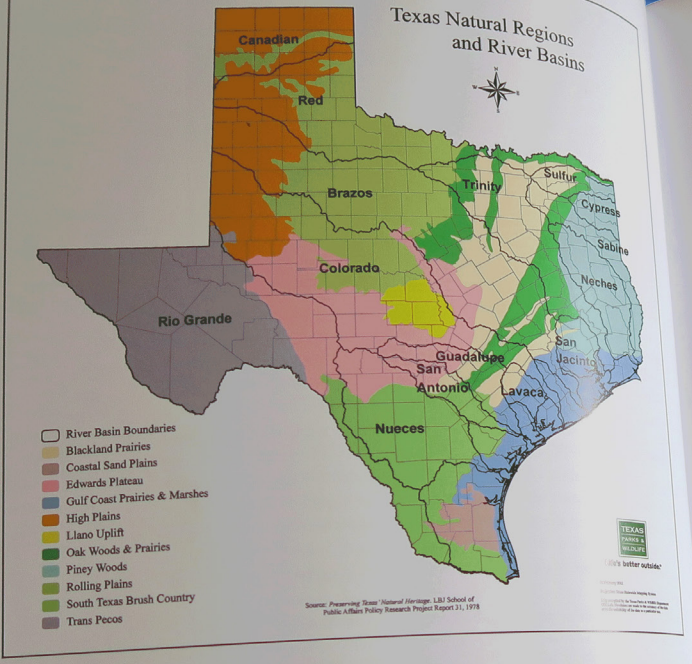


Figure 3.5. Texas natural regions and river basins. Map courtesy of Texas Parks and Wildlife Department.

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.

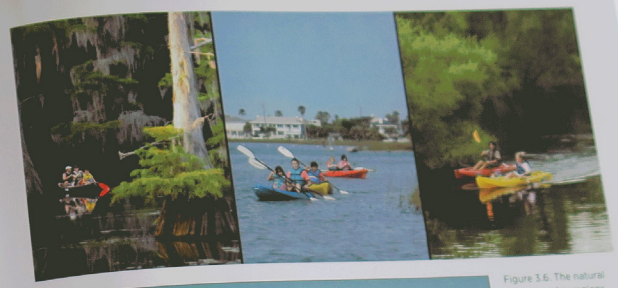


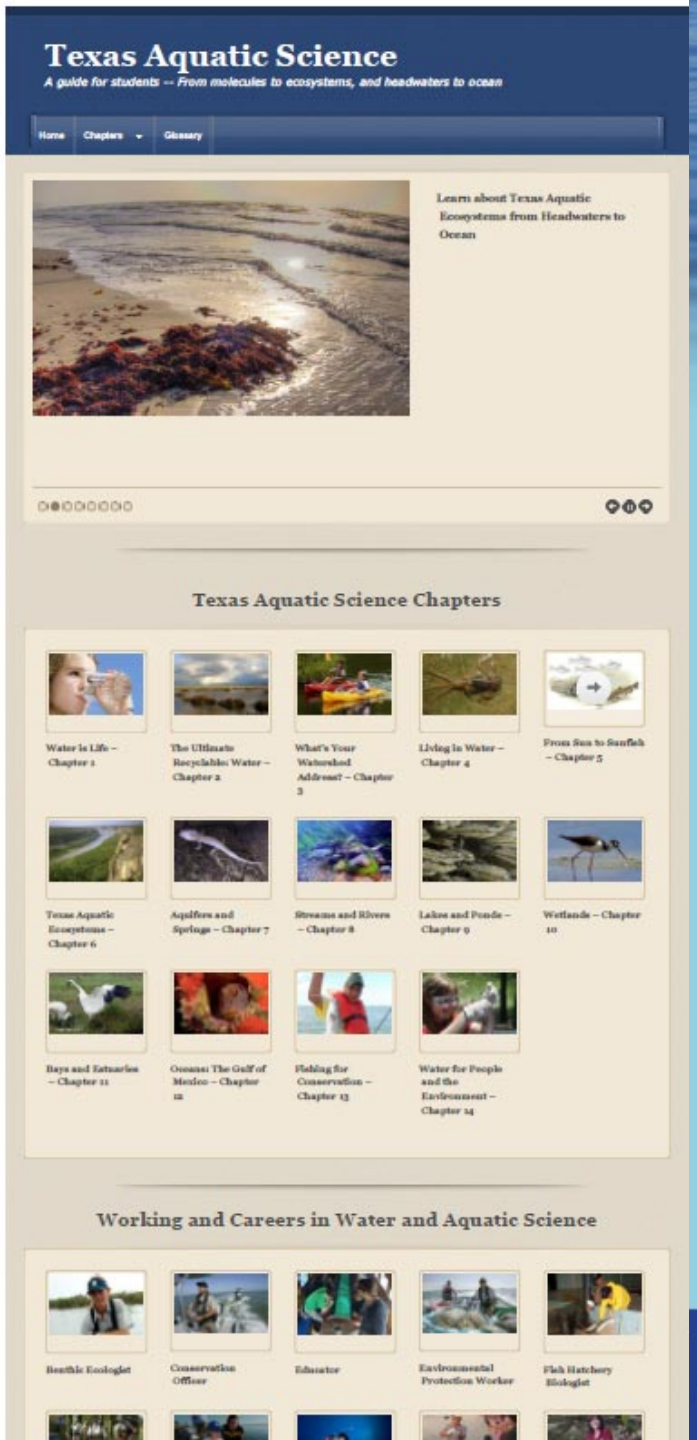
Figure 3.6. The natural physiographic regions in Texas can provide very different boating and fishing experiences. Canoeing in Caddo Lake in East Texas (left), paddling in Aransas Bay near Rockport (center), and kayaking at Parrie Haynes Ranch on the Lampasas River near Killeen (right). Photographs courtesy 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 Harte Research Institute for Gulf of Mexico Studies.

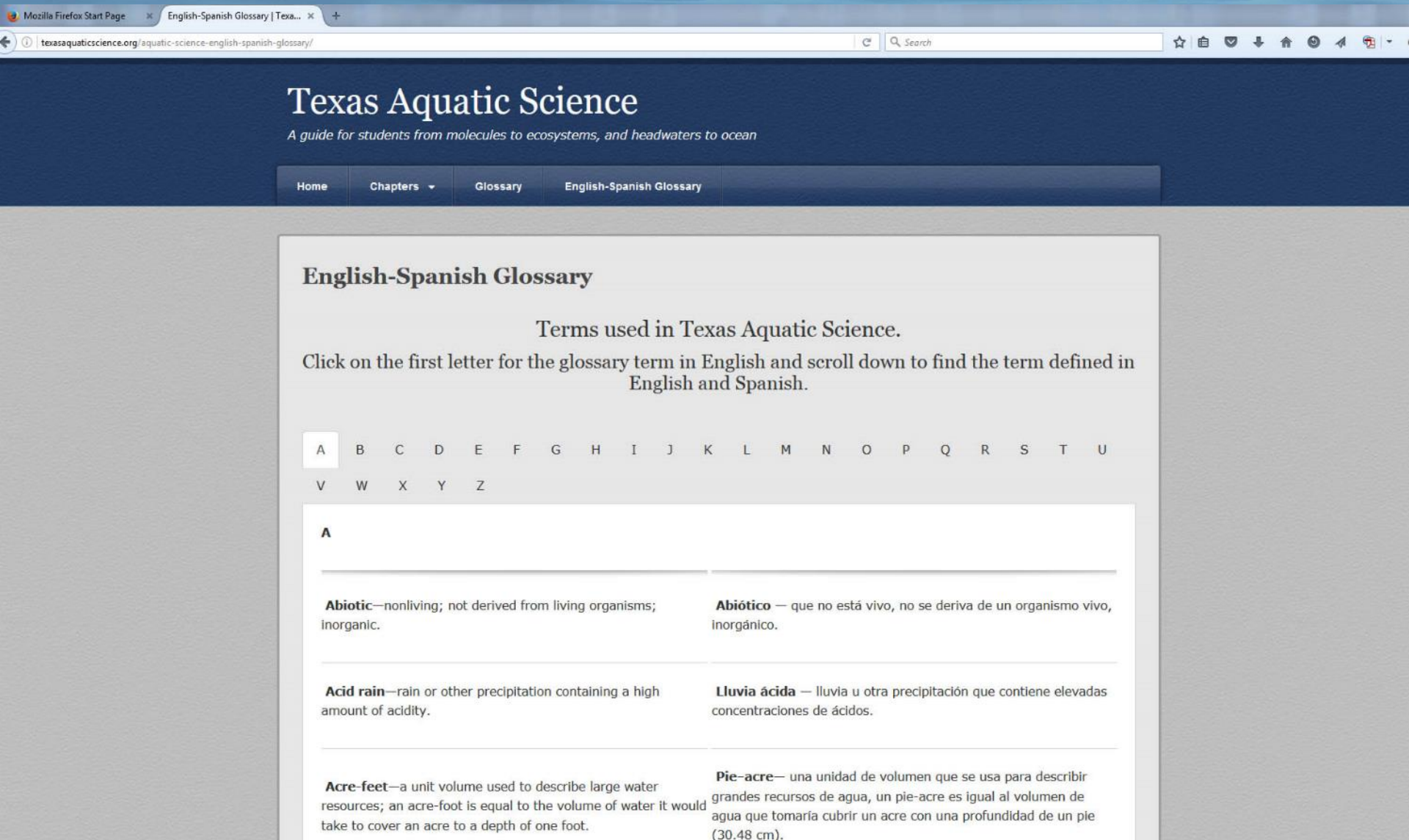


Texas Aquatic Science
Online

- texasaquaticscience.org
- **Textbook 100% and FREE**
- **Chapters**
- **Videos**
- **Career Promotions**
- **Science stories**
- **How to help**
- **TEKS Aligned**

eadwaters to Ocean

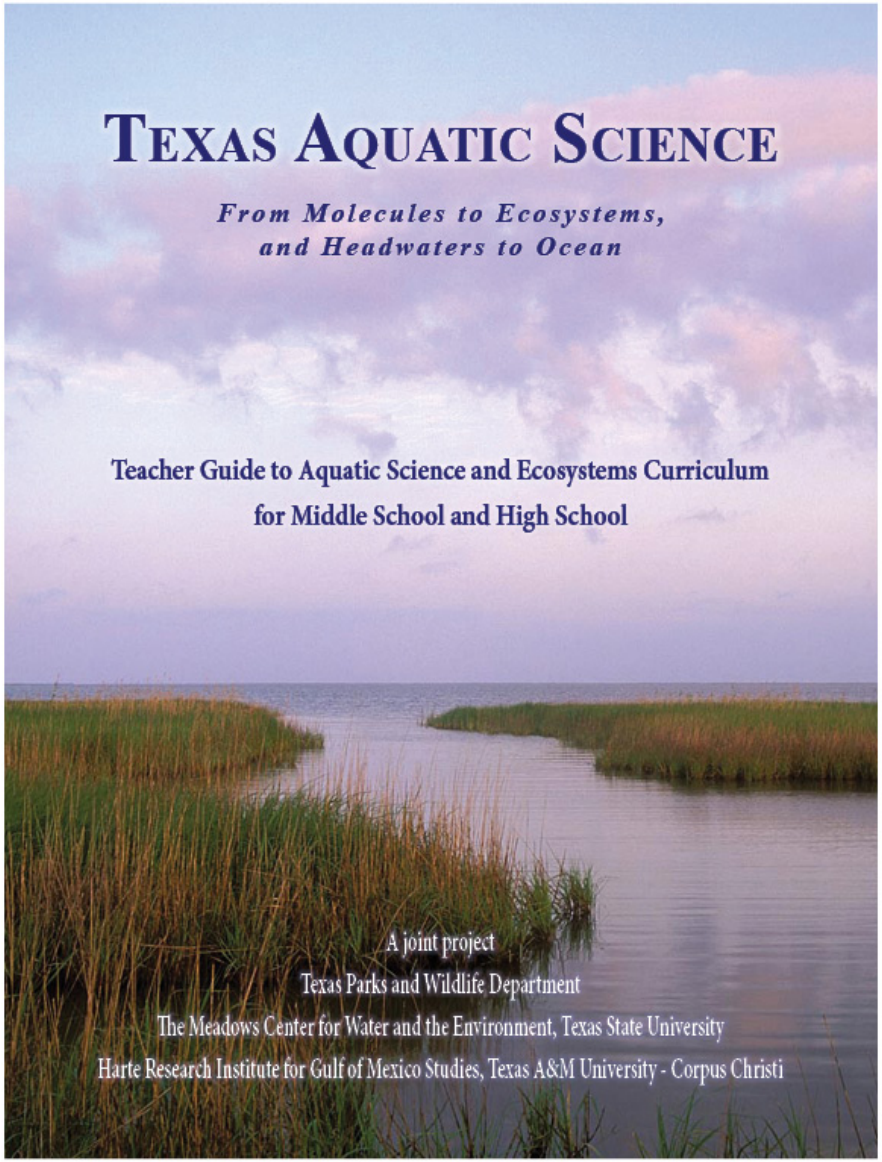
Texas Aquatic Science
Spanish – Glossary & Chapt. Videos



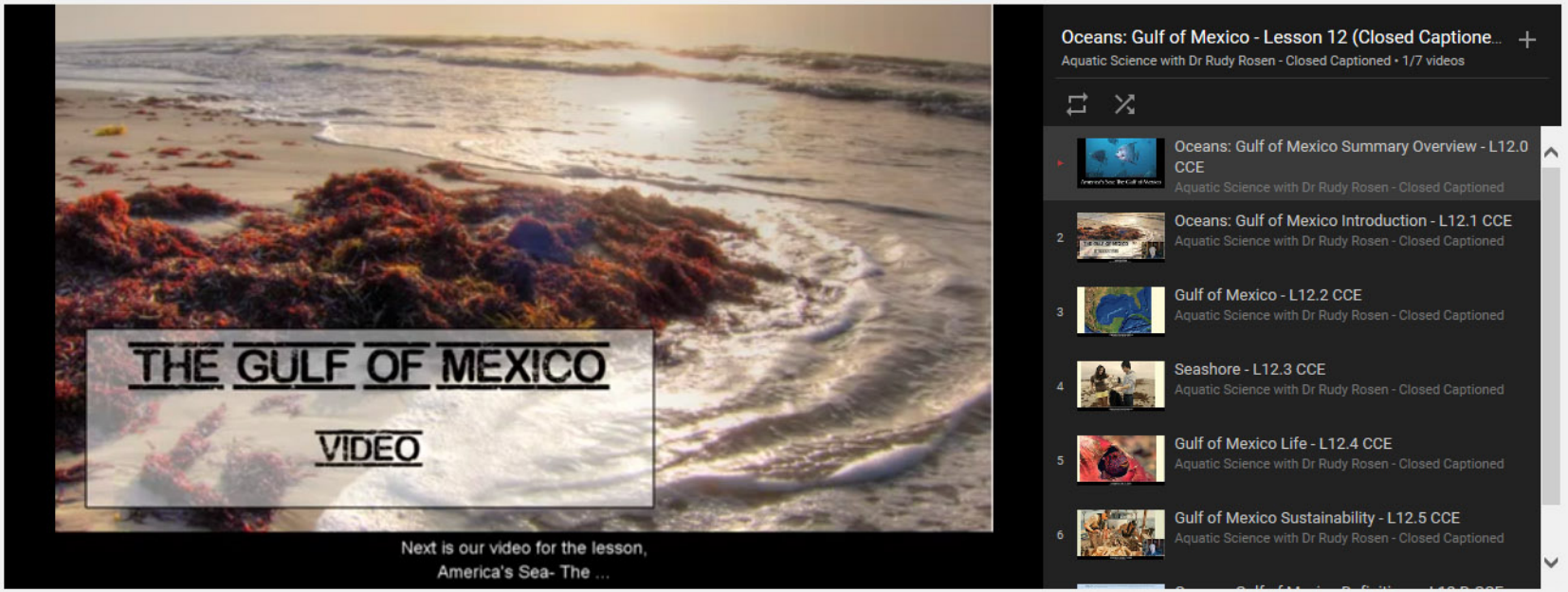
Texas Aquatic Science

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
Online Course lessons



H2O Headwaters to Ocean

Texas Aquatic Science
Online Lessons
225 videos – Closed Captioned

Interconnected Curriculum

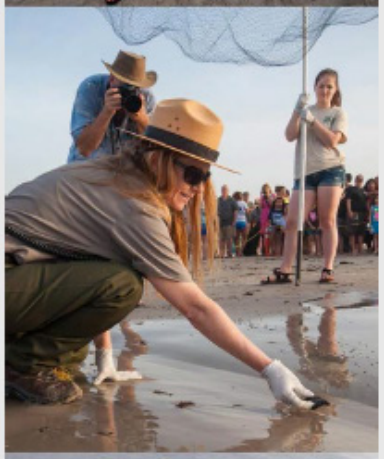
H2O Headwater

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.

Interconnected Curriculum

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

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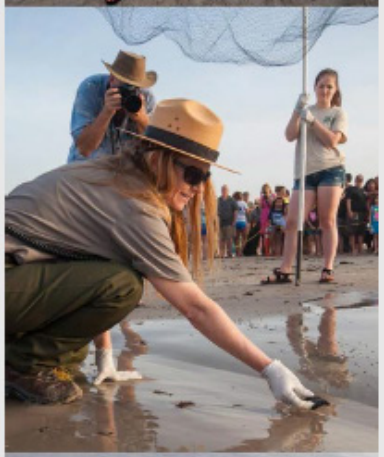

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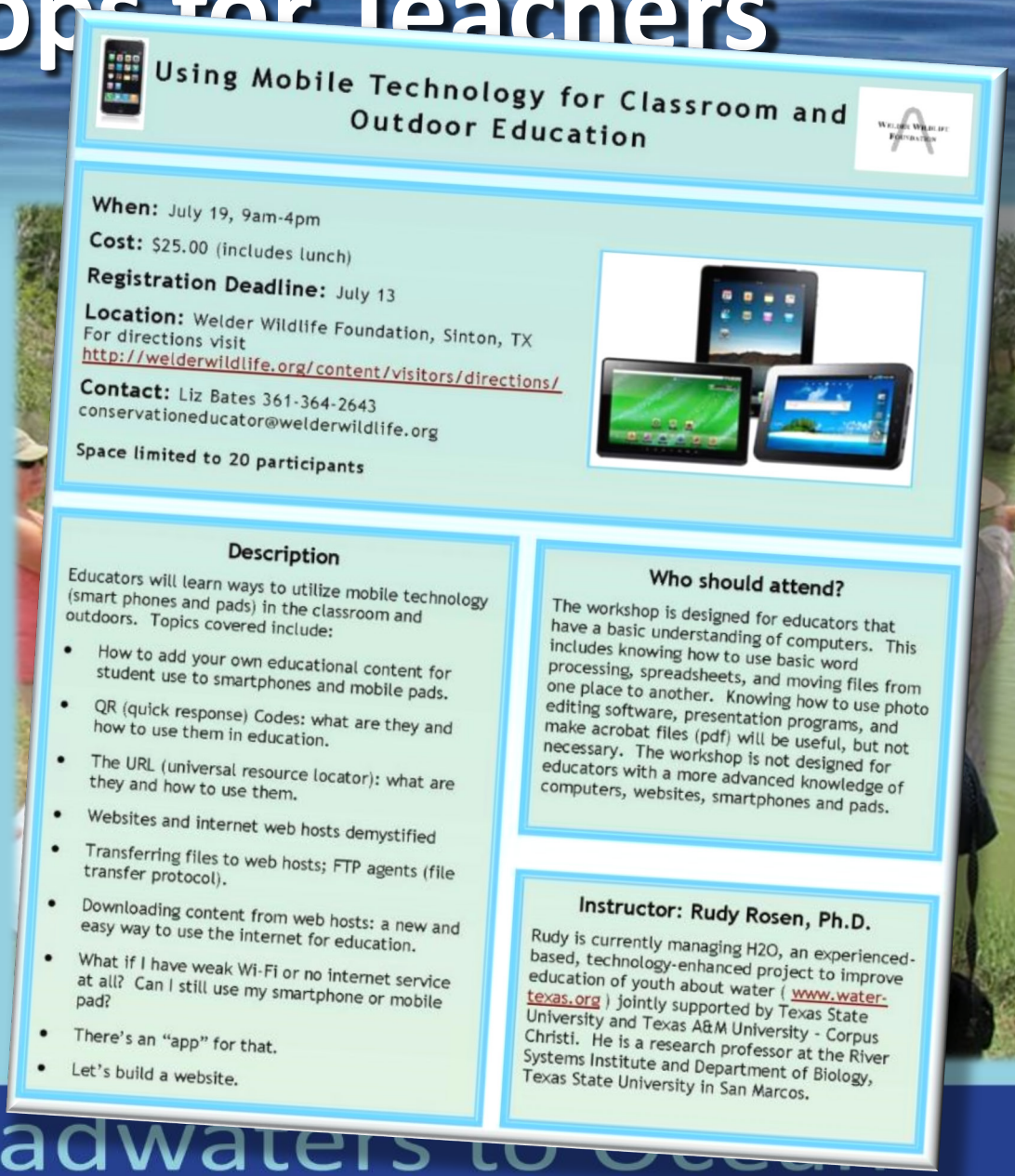
Workshops for Teachers

- **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
Certified Field Sites

- **Connect students to aquatic science with experiential learning outdoors**
- **65 sites (so far)**

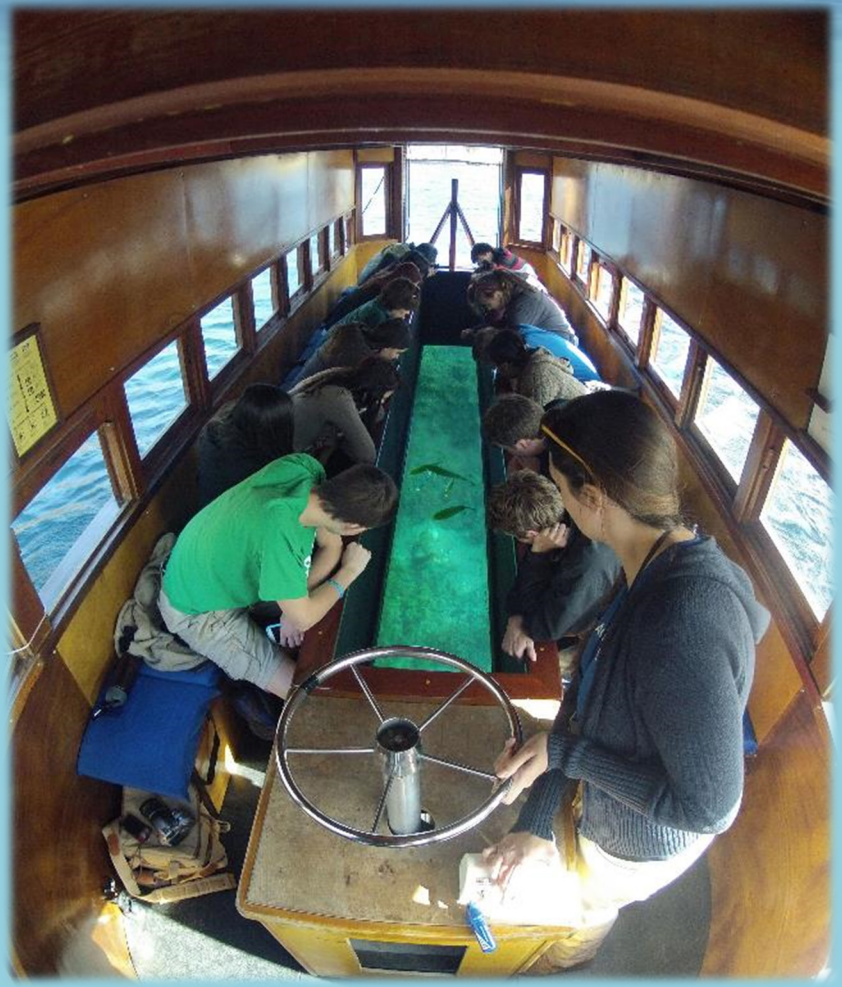
Effectiveness Research

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

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

Teacher Survey on Experiential Water Education Outdoors



- Students' understanding of water increased
- Teachers' understanding of teaching about water and awareness about water increased
- 4 out of 5 teachers say they will seek opportunities to engage students in issues related to water and the environment using technology after experiencing outdoors learning

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

POST-SECONDARY TRAINING

- Water workforce training and education need to be responsive to industry requirements and place-based realities for workers.
- Ensure **local access** and a **flexible pathway** to a water degree.
- Differently-sized communities:
  - Different kinds and scale of facilities
  - Different needs for water workers
  - Different training requirements

POST-SECONDARY TRAINING

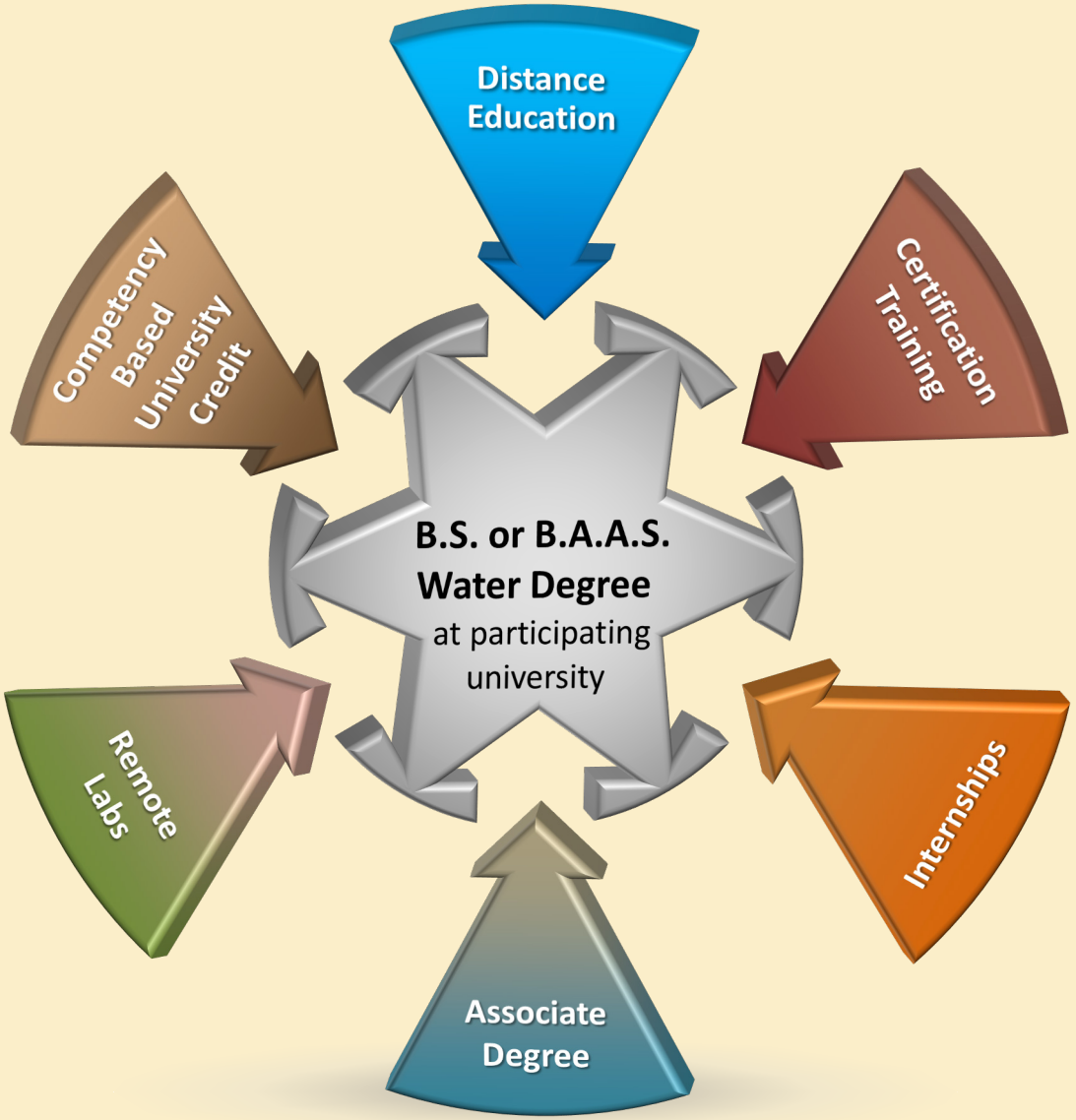
- Origins:
  - Texas water roadmap planning forums.
  - Development of B.S/B.A.A.S./M.S. degree programs at Texas A&M University in San Antonio and cooperative training discussions with TEEX (A&M's extension service), Northwest Vista College and Blinn College
  - Experiences developing curricula and degree programs.

AN EDUCATION MODEL TO A UNIVERSITY DEGREE

B.S. / B.A.A.S. DEGREES

- Ensure **local access** and a **flexible pathway** to a water degree:
  - Distance education
  - Extension & industry delivered education
  - Mobile laboratories
  - Community colleges
  - Regional universities

- Texas Core Curriculum provided by the Virtual College of Texas, supported by the Texas Association of Community Colleges.
- Training from trade industry sources or extension education (e.g., TEEX).
- Work-study at industry locations and water systems facilities.
- Two-year degree in Water Science and Technology at participating community colleges.
- Mobile training facilities for campuses not having labs and for training throughout rural Texas.
- Credit for previous experience and training courses taken.



WATER EDUCATION FOR TEXAS' FUTURE

1. Starts early and meets Texas standards
2. Adaptable to changing and emerging needs in water industries in rural and urban systems.
3. Addresses industry liability issues and regulatory requirements.
4. Meets emerging educational requirements for long-term employment and upward mobility of graduates.

LEARN

Texas Aquatic Science on the Web

https://Texasaquaticscience.org

Texas Water Journal (2018)

https://TWJ.media

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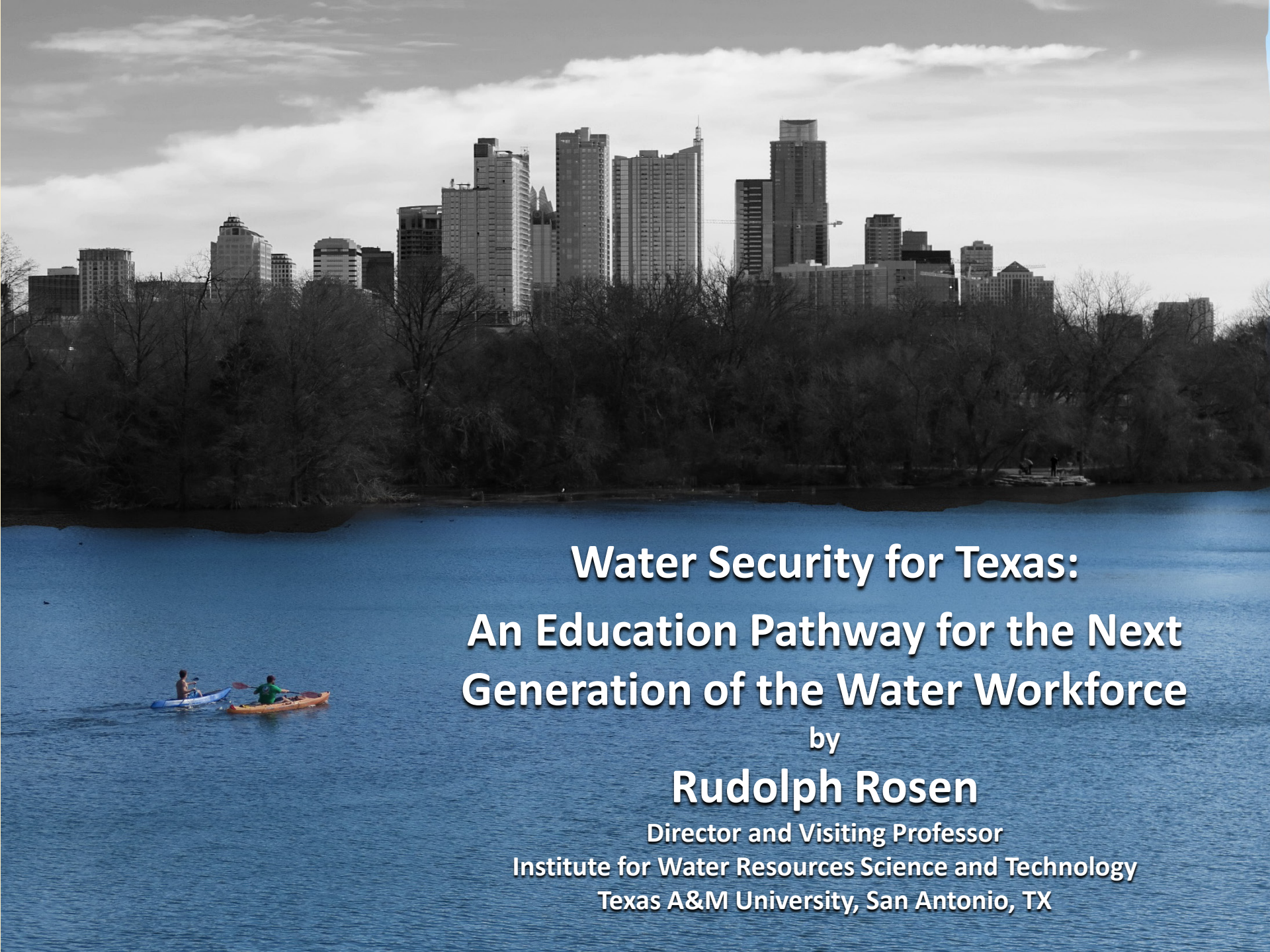
Rudolph Rosen, Luis Cifuentes, James Fischer, Howard Marquise, John C. Tracy



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