Photo credit: TNC

Socioeconomic Outcomes of Oyster Reef Restoration Projects:

Case Study of Galveston Bay, TX and Calcasieu Lake, LA

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ACES: A Community on Ecosystem Services Conference. Austin, TX
Session: Investing in ES: Tools and Approaches for Measurement and Valuation

December 10, 2024

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The Nature Conservancy

Introduction

- In the Gulf of Mexico 50-80% of native oyster populations have been lost relative to historic levels (Beck et al. 2011).
- Oysters provide several ecosystem services: essential habitat, supporting secondary and tertiary production, nutrient regulation, shoreline protection, wave attenuation, potential oyster harvest, and recreational fishing opportunities (Coen et al. 2007; Stunz, Minello, and Rozas 2010; Olander et al. 2020; Smith, Cheng, and Castorani 2023).
- In Texas, over 500 acres of oyster habitat in Texas estuaries since 2009 (TPWD 2022).
- Despite these efforts, the decline in oyster populations continues, highlighting the need for sustained restoration (The Nature Conservancy 2023).

Photo credit: TNC

Motivation

- Considering ongoing restoration efforts, there is a need to better understand and capture evidence of the linkages between restoration/conservation and well-being (McKinnon et al. 2016; NAS, 2017).
- Ecosystem service logic models provides a framework for developing metrics to monitor socioeconomic outcomes (Olander et al., 2024).
- Studies related to provisioning of ES outweigh the studies of the demand for ES (Haase et al 2014).
- Interviews and surveys are useful tools for assessing demand of ES and perception of restoration outcomes (Kaźmierczak, 2013; Martinez et al, 2013; Alba-Patiño el al., 2021).


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Project Goals & Objectives

- **Identify relevant metrics that could be used to monitor the socioeconomic outcomes of oyster reef restoration for the TNC Galveston Bay and Calcasieu Lake Oyster Restoration Projects**
- Assess the public awareness and perception of the TNC Galveston Bay and Calcasieu Lake Oyster Restoration Projects

Today's presentation:

- **Identify relevant metrics that could be used to monitor the socioeconomic outcomes of oyster reef restoration for the TNC Galveston Bay and Calcasieu Lake Oyster Restoration Projects**
    - *Identify evidence of linkages for oyster restoration ecosystem service logic models using expert interview and public surveys*

e public awareness and perception of the TNC
ı Bay and Calcasieu Lake Oyster Restoration

Project Page

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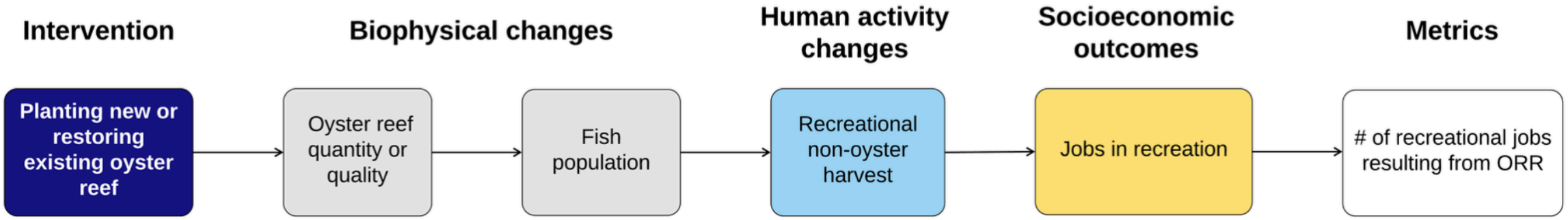
Gulf of Mexico Ecosystem Service Logic Models & Socio-Economic Indicators (GEMS)



https://nicholasinstitute.duke.edu/project/gems/models/about

Olander et al. 2024

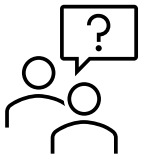
- Identified metrics for social and economic outcomes of coastal restoration (employment, local economy, recreation, food provision, and mental health benefits).
- Co-developed with restoration practitioners, researchers, and stakeholders and verified though literature.
- Provides a framework for assessing Ecosystem Services

Ecosystem Service Logic Model Framework

To identify locally relevant and project specific socioeconomic metrics:

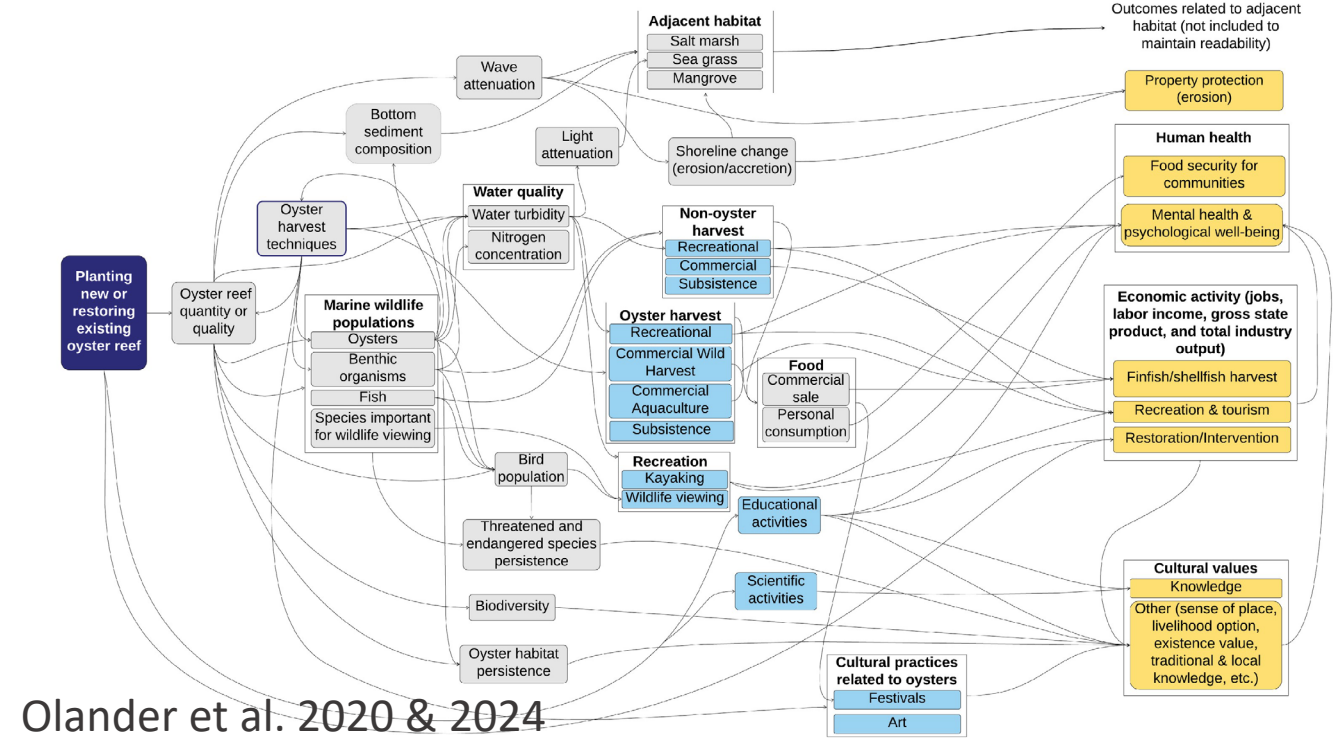
- Expert Interviews
- Public Survey

Evidence of Linkages

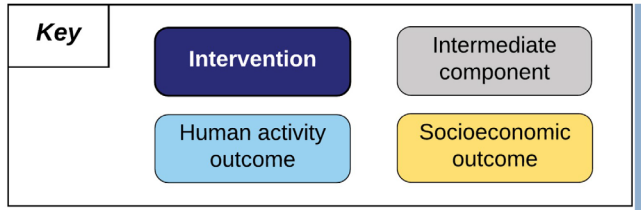


Ecosystem Service Logic Model (ESLM) for Oyster Reef Restoration

http://bit.ly/NI-GEMS



Olander et al. 2020 & 2024



Duke NICHOLAS INSTITUTE National Ecosystem Services PARTNERSHIP

BRIDGE COLLABORATIVE

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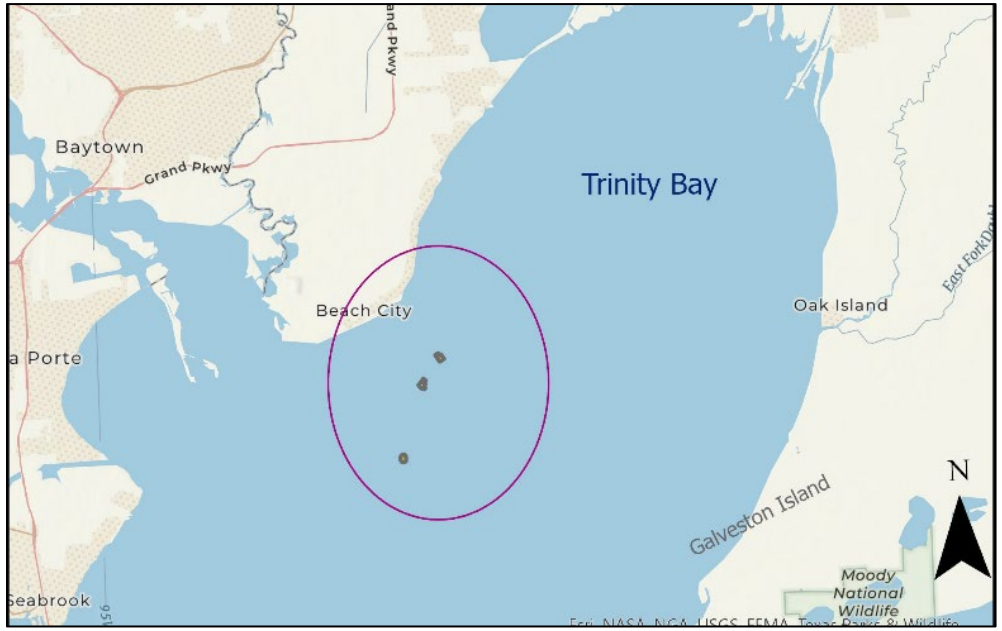
Oyster Reef Restoration Design: Galveston Bay (Beezley Reef)

- Subtidal Reef- Hybrid approach to restoration, consisting of part sanctuary and part harvestable reef constructed in 2021.
- Roughly 40 acres in size, where 15 acres of the reef will be open for harvest.
- Project Benefits:
    - Supply oyster larva to harvestable reef sites
    - Provide food and shelter for over 100 different species of fish, shrimp, crabs and other invertebrates.
    - Help filter coastal waters and enhance water quality



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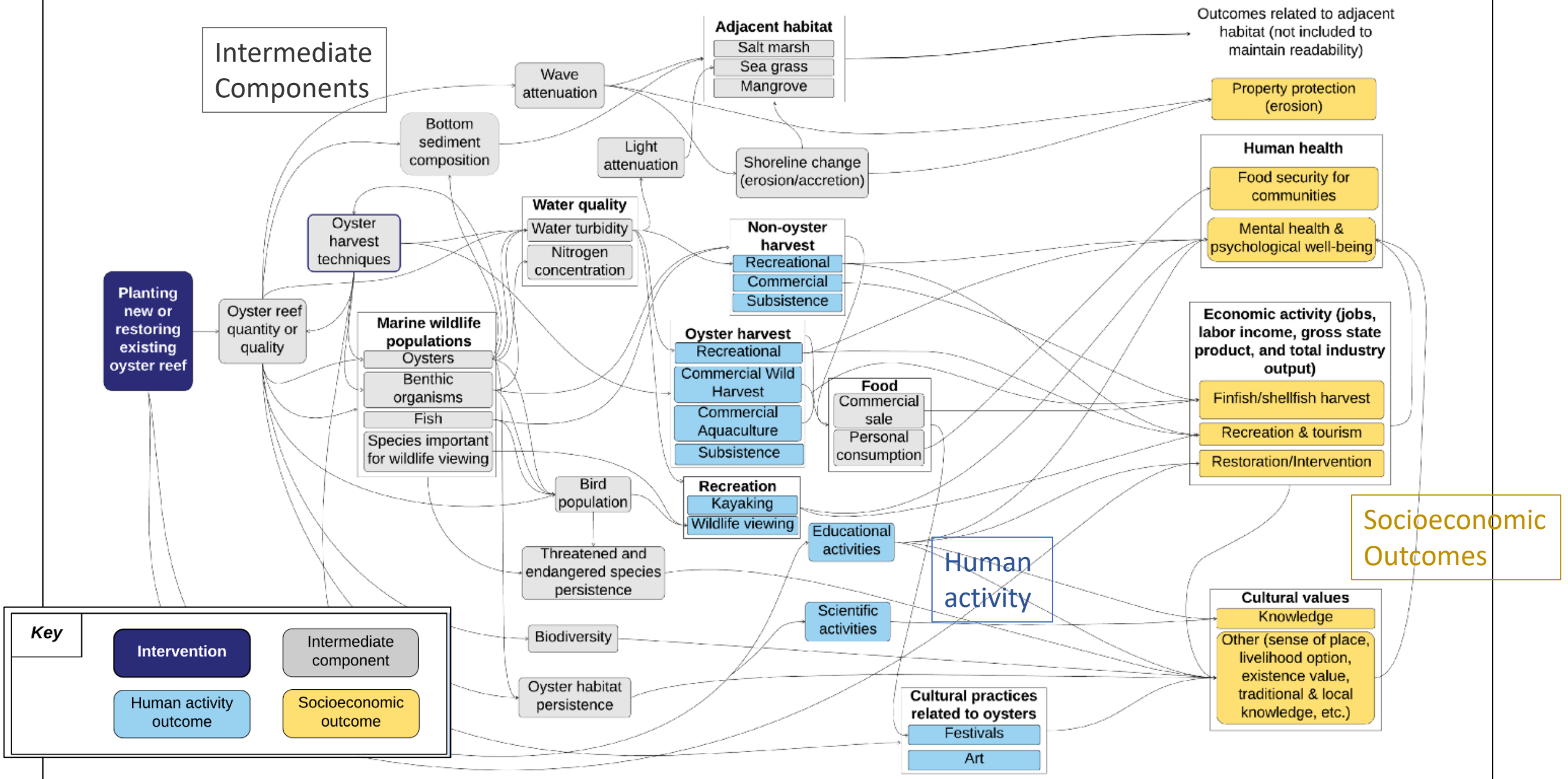
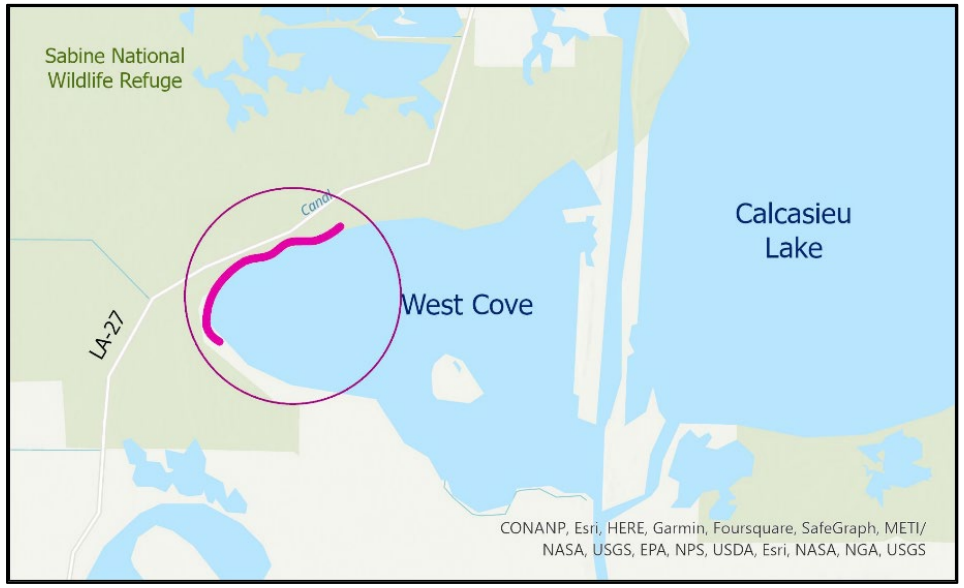
Ecosystem Service Logic Model (ESLM) for Oyster Reef Restoration

Methods Framework: Galveston- Oyster Reef Restoration



Oyster Reef Restoration Design: Calcasieu Lake

- Nearshore intertidal oyster reef
  - 2.5 miles of gabions (6x6x1 ft) which are filled with limestone & and shells that create structure for oysters to grow
  - Constructed in phases, most recent phase completed in 2022.
  - Project Benefits:
    - Reduce shoreline erosion
    - Protect from coastal flooding
    - Enhance estuarine habitat
    - Support recreational opportunities



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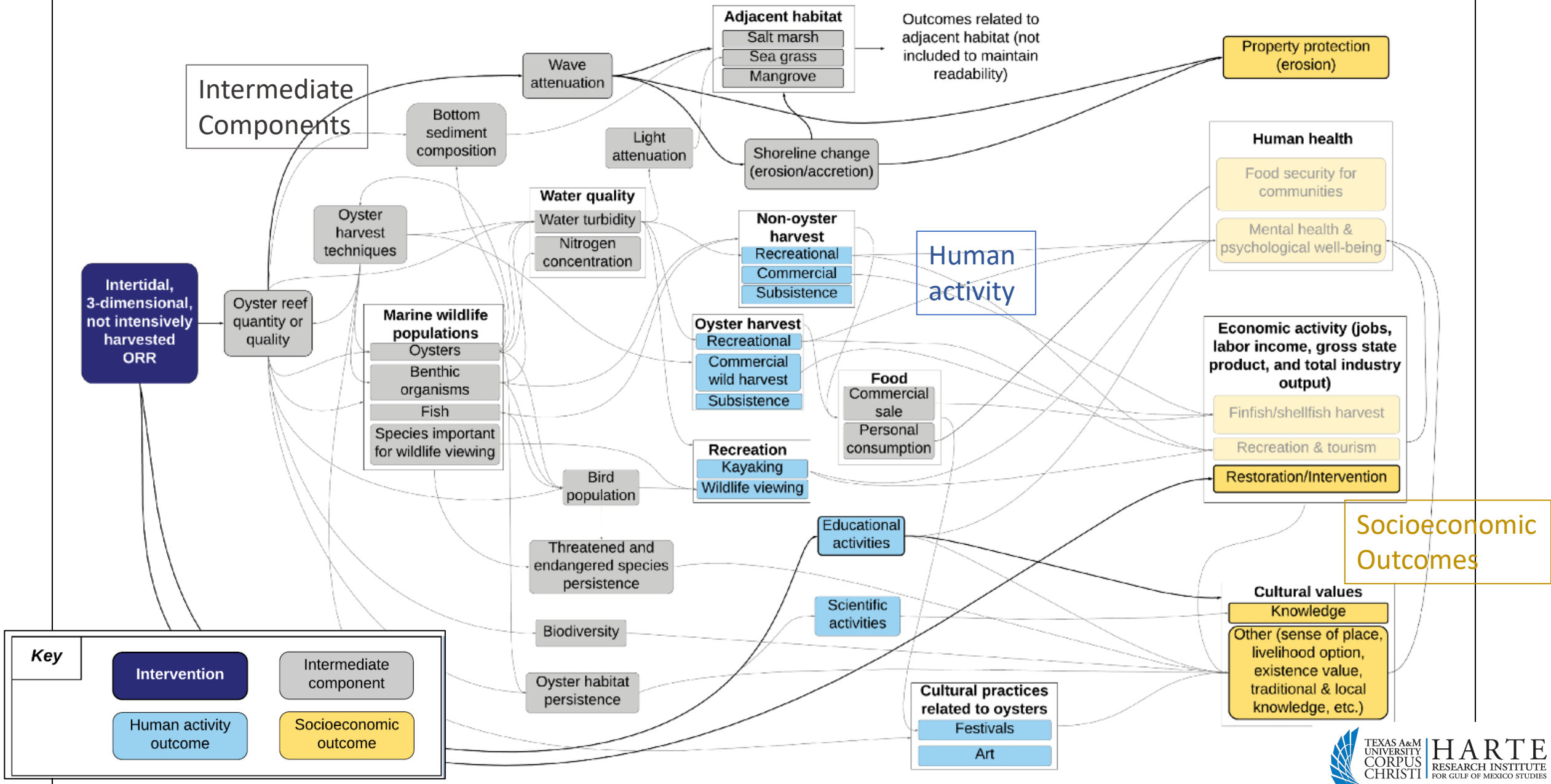
Ecosystem Service Logic Model (ESLM) for Intertidal, 3-Dimensional, Not Intensively Harvested Oyster Reef Restoration

Methods Framework: Calcasieu-Intertidal, non-harvested oyster reef



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Expert Interviews

- Design:
  - Gather details on projects from diverse point of view
  - Identify potential linkages for Ecosystem Service Logic Model
  - Identify potential socio-economic metrics to monitor
  - Gain insight for survey design and distribution
- Collected between Aug 8, 2023- Sept 28, 2023
- 20 min- 1 hr in length
- 5 interviews for Beezley site and 7 for Calcasieu site representing various industries
- Imported, Coded, and Analyzed in MAXQDA

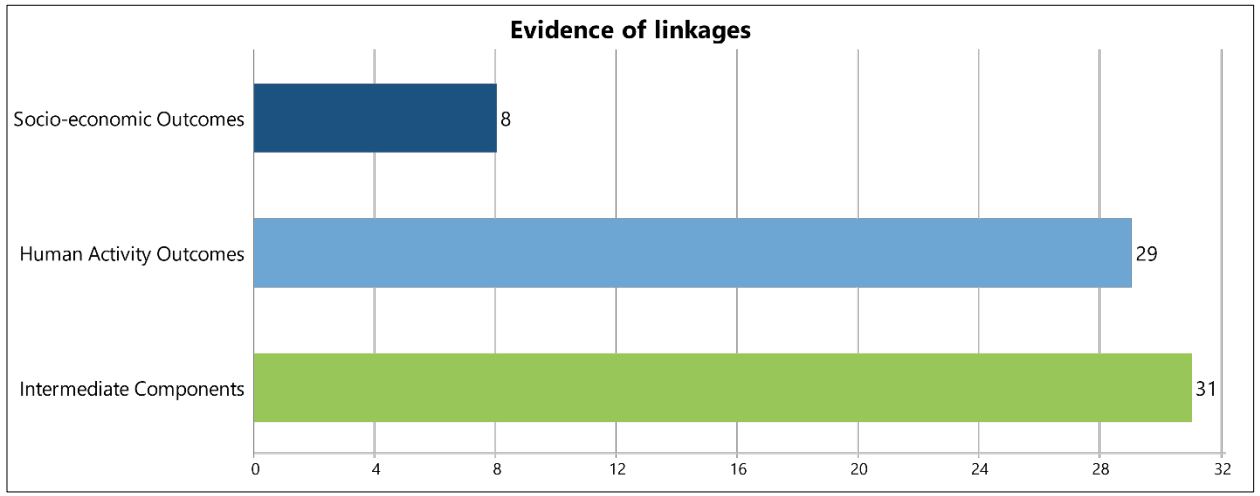
Table 1. Beezley Reef Expert Interviews

Expert Category	Title
Engineering	Coastal Technical Lead
Industry	Commercial Oyster Fisherman-Owner
Non-profit	Director of Program Operations
State Agency	Coastal Ecologist
Fisheries extension	Program Director, Sustainable Fisheries and Aquaculture

Table 2. Calcasieu Lake Expert Interviews.

Expert Category	Title
Engineering	Owner
Engineering	Project Manager/Civil Engineer
Extension	Extension Agent
Industry	Boat Captain/Angler
Non-profit	Director of Civic Initiatives
Non-profit	Coastal Conservation Project Manager
State Agency	Marine Fisheries Regional Office Manager

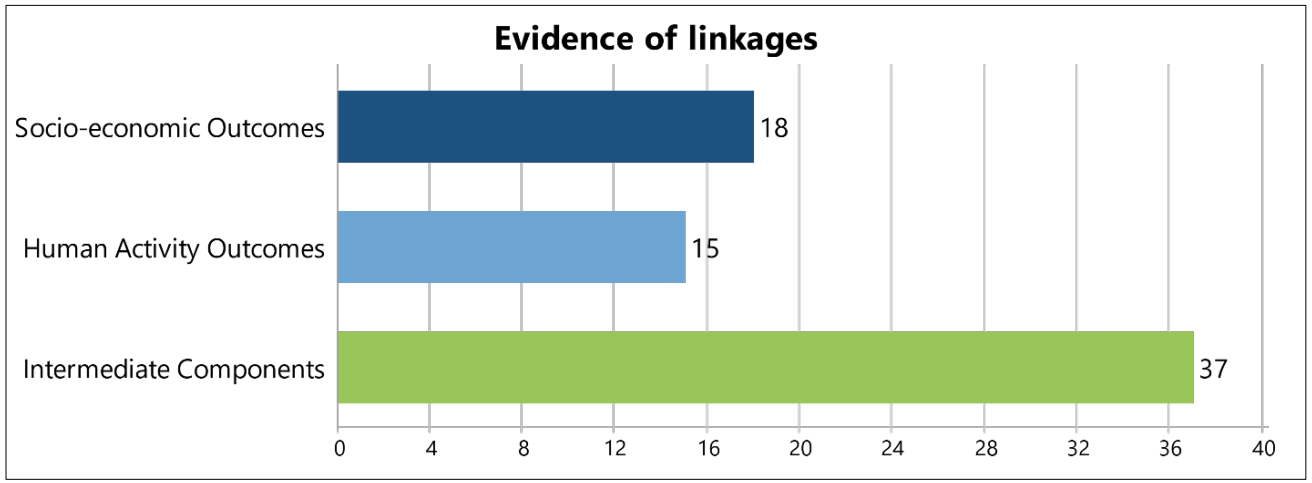
Expert Interview Results: Galveston Bay



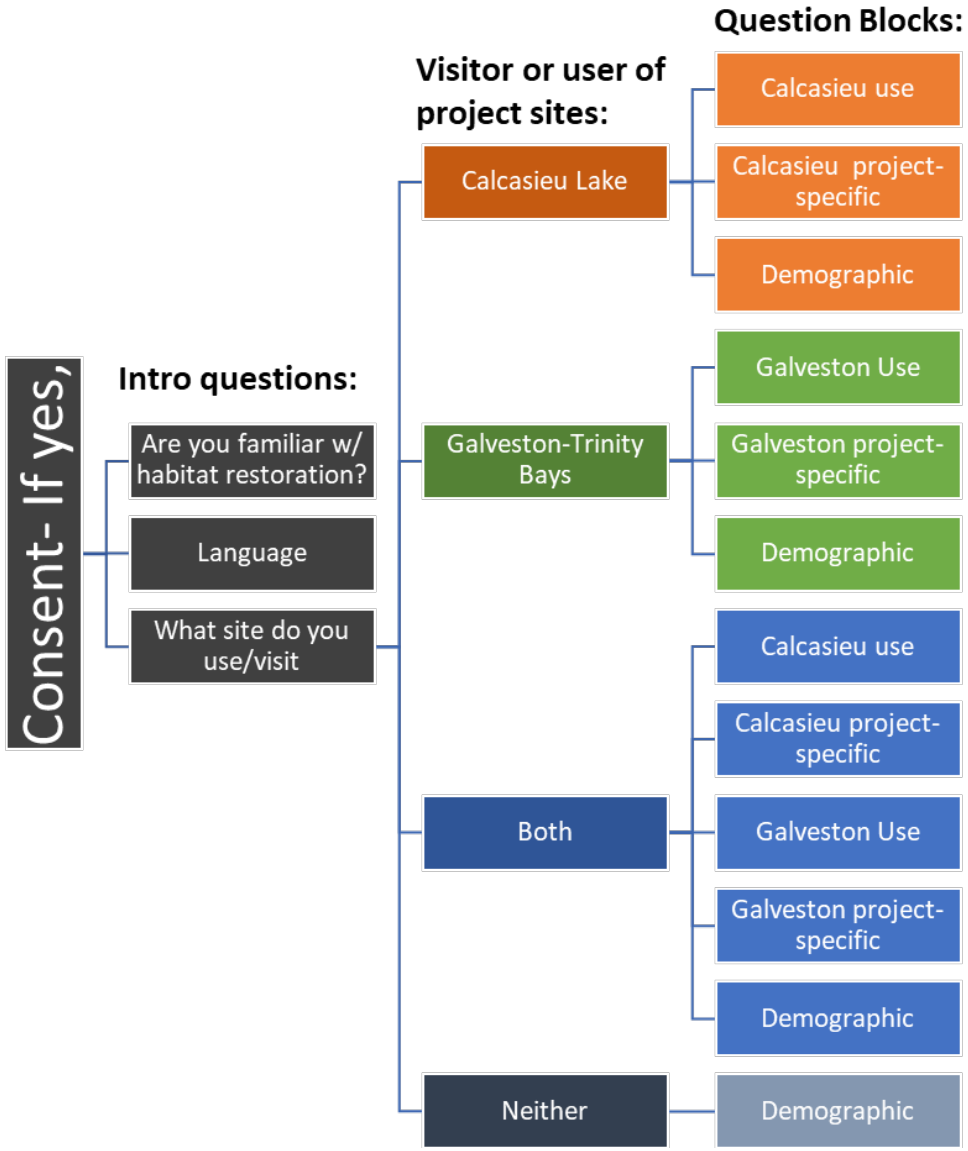
Coded segments

- Evidence of linkages in ecosystem service logic models.
  - Socioeconomic outcomes: economic activity from construction, enhanced oyster harvest
  - Human activity: education, scientific activity, oyster harvest, non-oyster harvest
  - Intermediate components: comments highlight oyster restoration contributes to enhanced biodiversity, water quality, and marine wildlife population to support oyster/non-oyster harvest, recreation and economy

Expert Interview Results: Calcasieu Lake



- Evidence of linkages in ecosystem service logic models.
  - Socioeconomic outcomes: comments highlight in interconnectedness of habitat quality, recreational activity, tourism and the economy
  - Human Activity: possible sport fishing, commercial fishing, sport tournaments, educational activity
  - Intermediate Components: shoreline protection, enhancing habitat quality and support estuarine species



Public Survey Design

- Survey design (Qualtrics)
  - Organized into question blocks
  - Series of multiple choice and open-ended questions
- Survey goals
  - Assess use & environmental concerns of the study site
  - Assess knowledge and perception of TNC's oyster reef restoration projects

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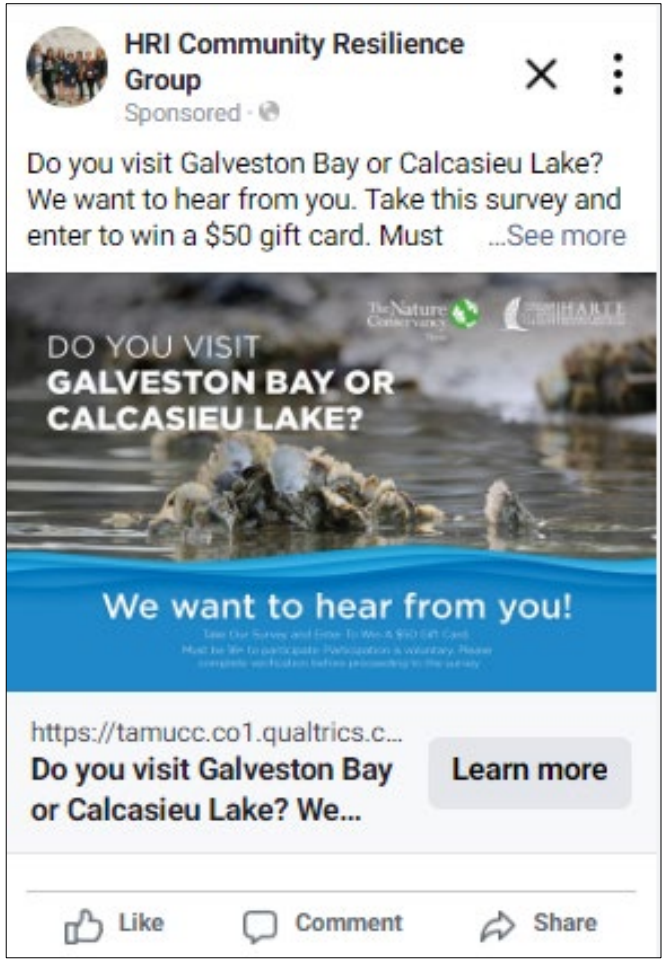
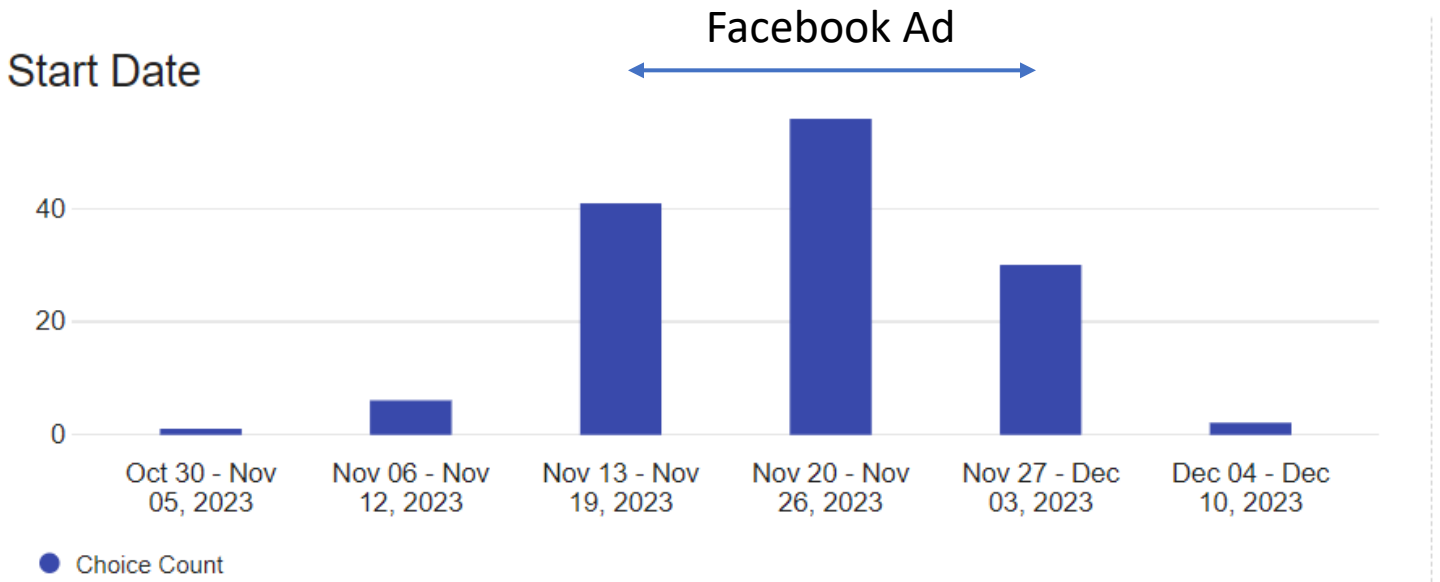
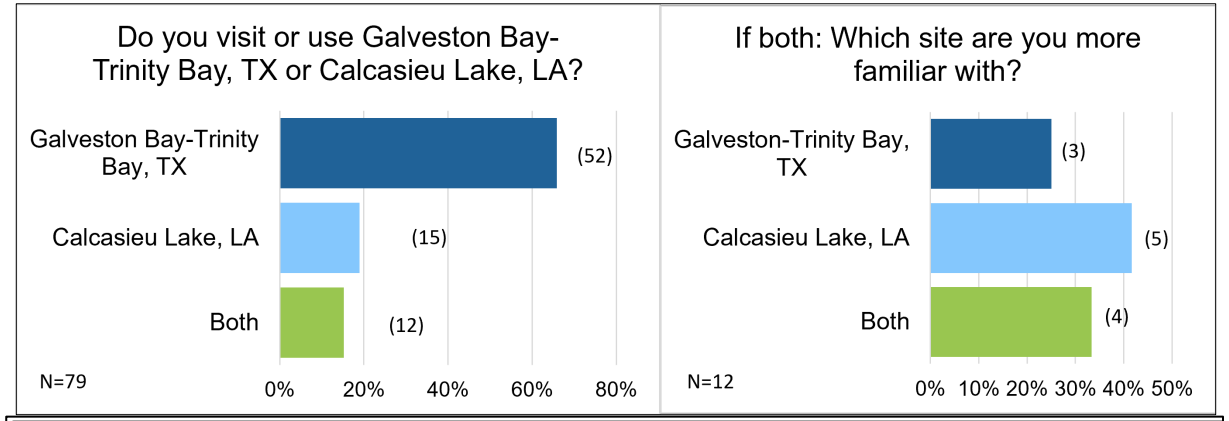
Surveys

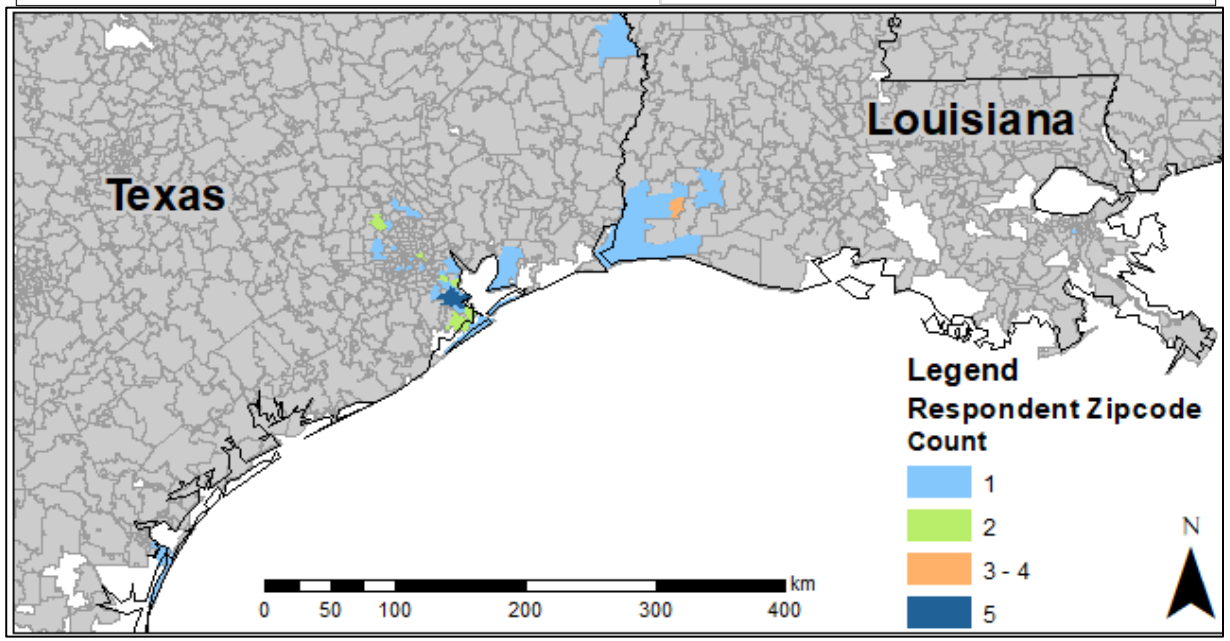




Filter Criteria	filtered records	Data records remaining
starting records		136
Consent granted	38	98
Captcha score >0.4	3	95
Progress >10%	7	88
Duration > 120 seconds	5	83
Readable and appropriate text	4	79

Public Survey Results





- 96% responses in English
- 66% Galveston and 19% Calcasieu
- 70 zip codes:
  - In TX, majority from communities surrounding Galveston Bay and Houston.
  - In LA, most from Cameron Parish and Lake Charles

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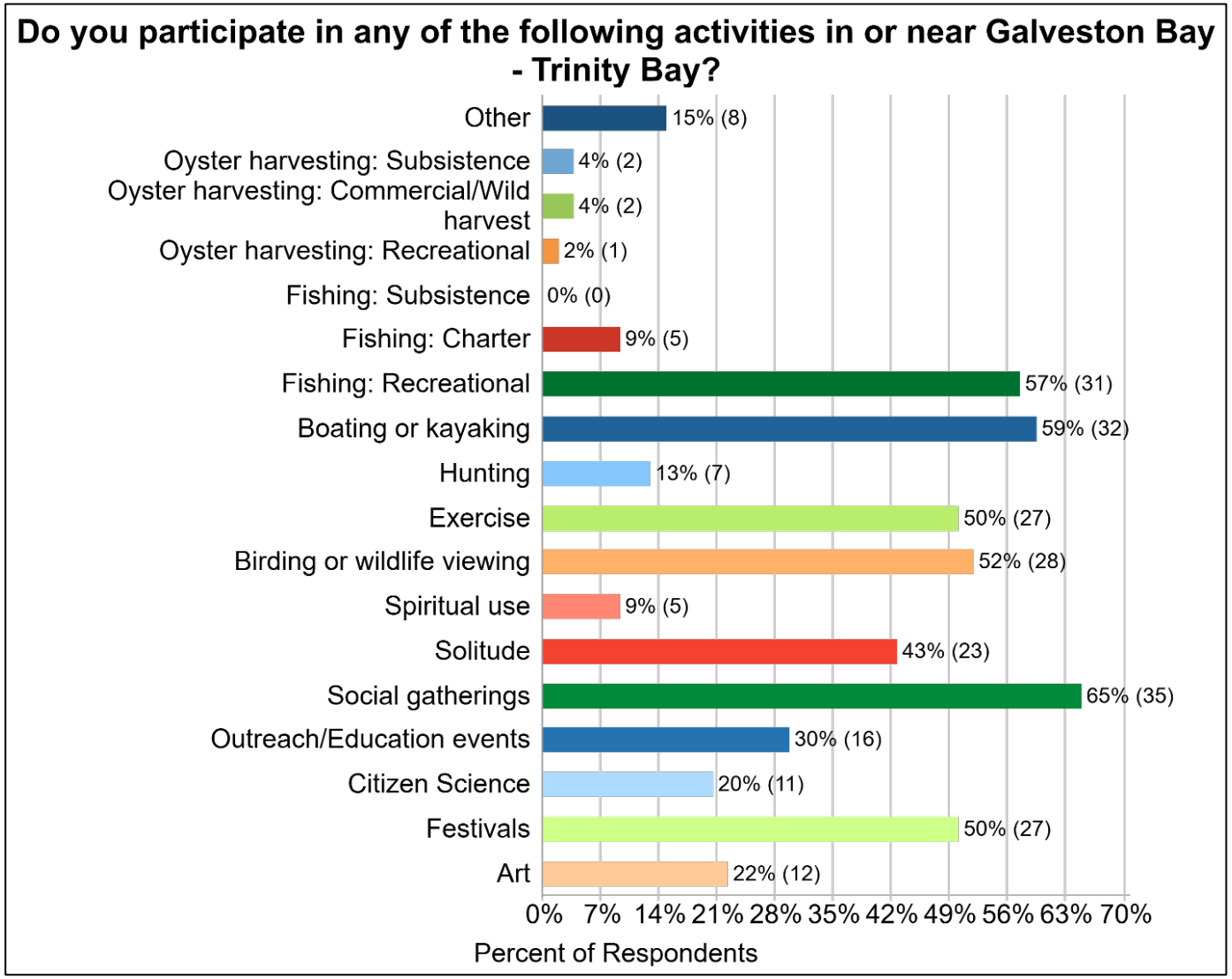
Coding for Evidence of Socioeconomic Outcomes

Code System	Description/Notes
Socioeconomic Outcomes	
Economic Activities	Comments provided by participants regarding impact to jobs, business, and recreation; Comments pertaining to working in the Bay/Lake
Restoration/Intervention	Benefit from construction, planning, monitoring or association with restoration
Finfish/shellfish harvest	Oyster harvesting: Commercial/wild harvest Oyster harvesting: Subsistence; Fishing: Subsistence
Recreation & Tourism	Social gathering/socializing ; Birding or wildlife viewing Exercise (swimming, walking, running, biking, etc) ; Hunting Boating or kayaking; Fishing: Recreational ;Fishing: Charter Oyster harvesting: Recreational Comments pertaining to recreation or entertainment
Property Protection	
Property Value	Comments regarding property value/protection
Erosion	Concern for shoreline erosion
Human Health	
Mental Health & Well-being	Solitude
Food Security for Communities	Fishing: Subsistence
Cultural Values	
Other	*sense of place, livelihood option, existence value, traditional & local knowledge* Spiritual use Art Festivals Social gathering/socializing Comments expressing appreciation for oyster reef or restoration
Knowledge	Awareness of restoration or project; Academic research/Citizen science ; Outreach/Education events Comments expressing wanting to learn, volunteer, or be involved
	Oyster Restoration

Galveston Bay, Beezley Reef Responses

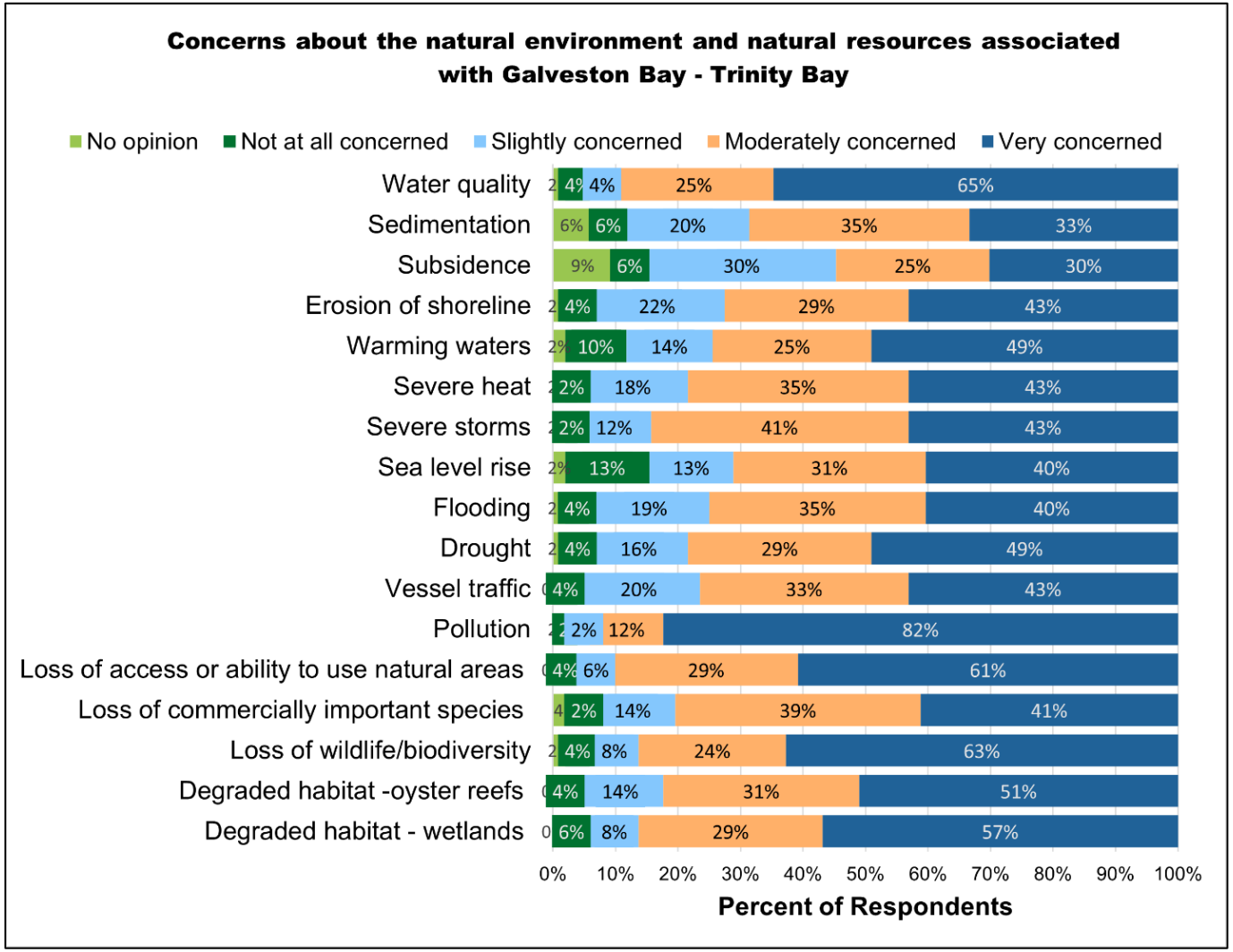
- Galveston-Trinity Bay is an important resource to surrounding communities. Over 50% of respondents report using the bay for:
  - Social gatherings
  - Boating/kayaking
  - Recreational fishing
  - Birding and wildlife viewing
  - Exercise



Galveston Bay, Beezley Reef Responses

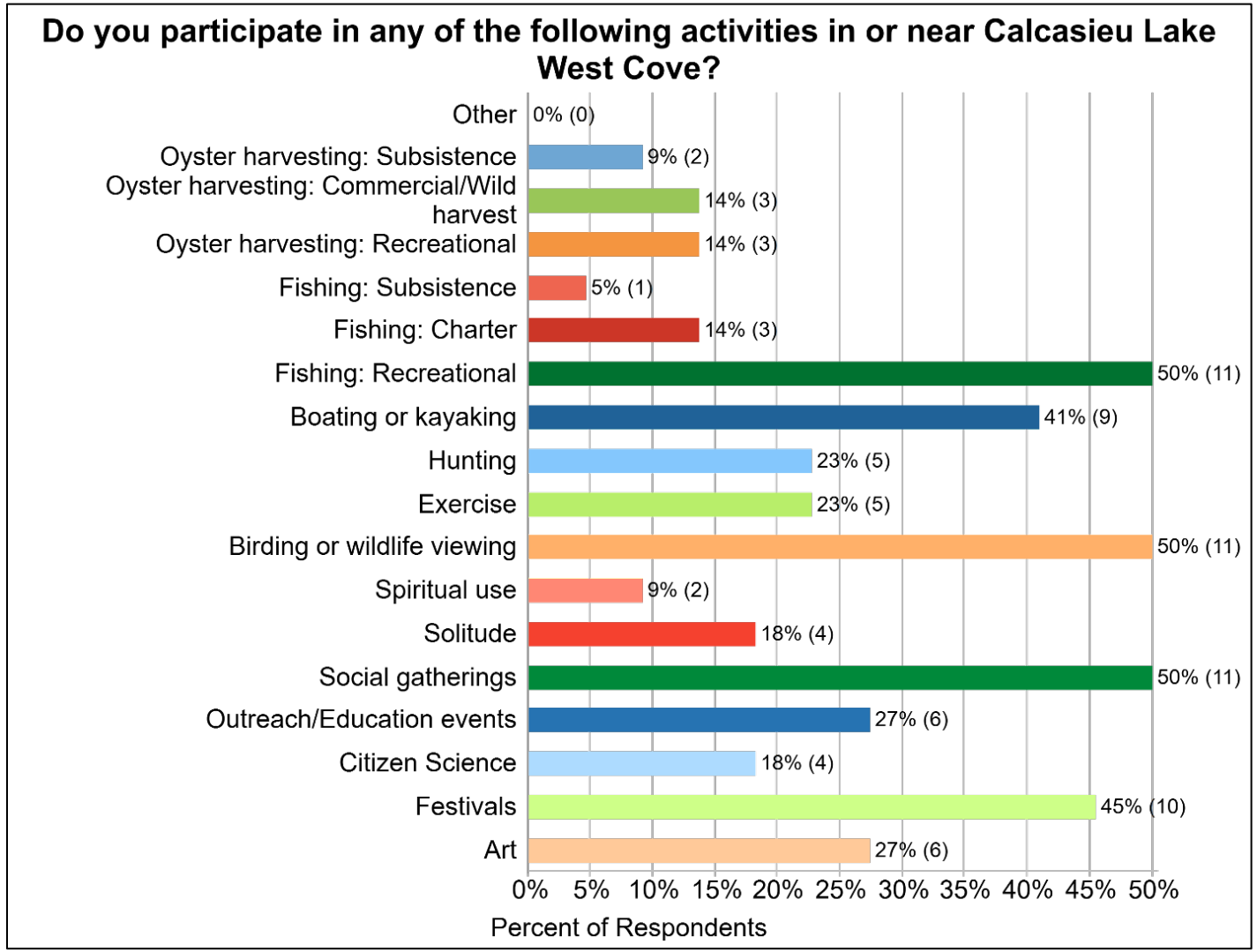
Environmental concerns reported by participants, were over 50% of respondents report being “very concerned” for:

- Pollution (82%)
- Water quality (65%)
- Loss of wildlife/biodiversity (63%)
- Loss of access or ability to use natural areas (61%)
- Degraded habitat- wetlands (57%)
- Degraded habitat- oyster reefs (51%)



Calcasieu Lake Reef Responses

- Calcasieu Lake is an important resource to surrounding communities. Over 50% of respondents report using the lake for:
  - Social gatherings
  - Recreational fishing
  - Birding and wildlife viewing

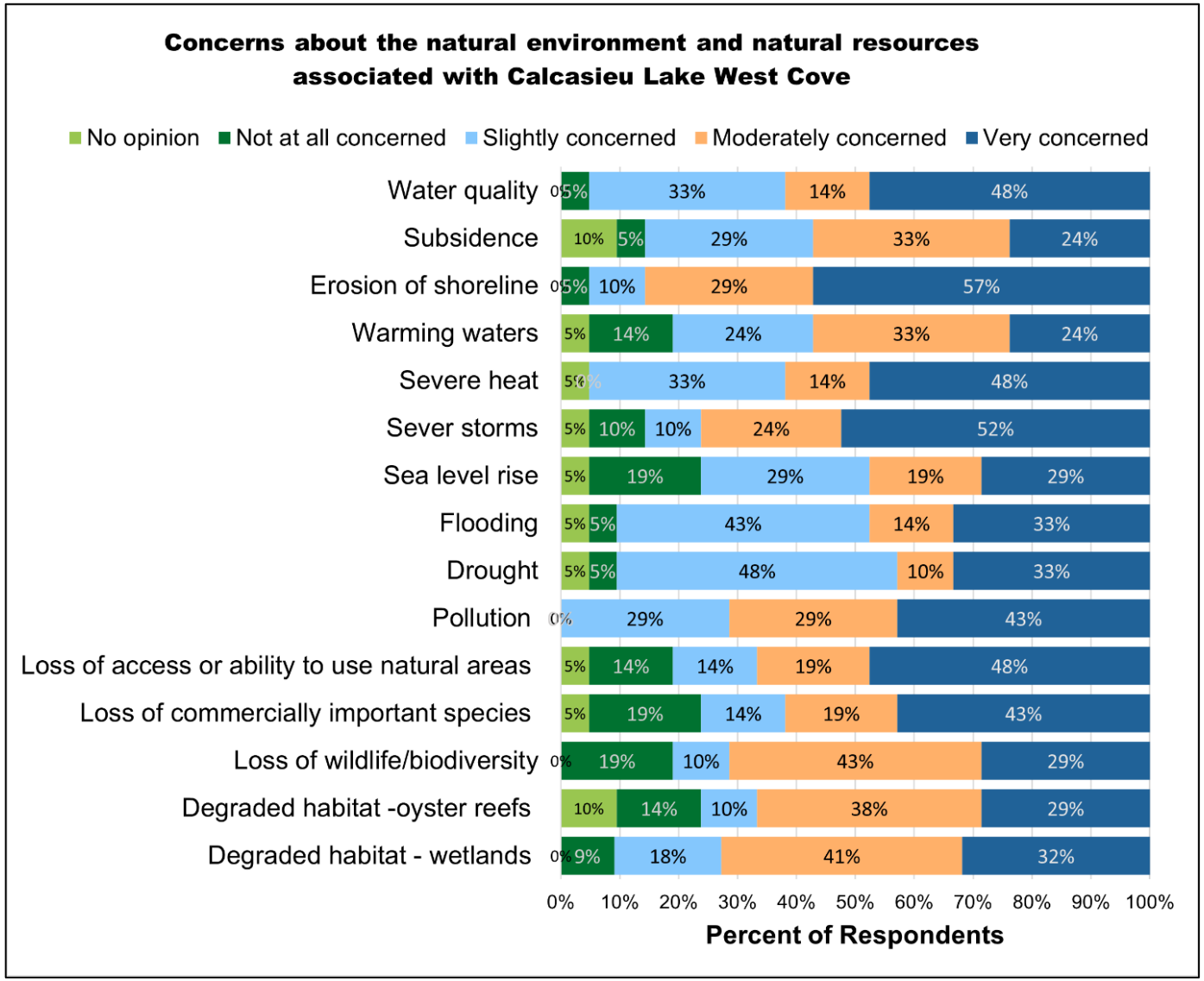


Calcasieu Lake Reef Responses

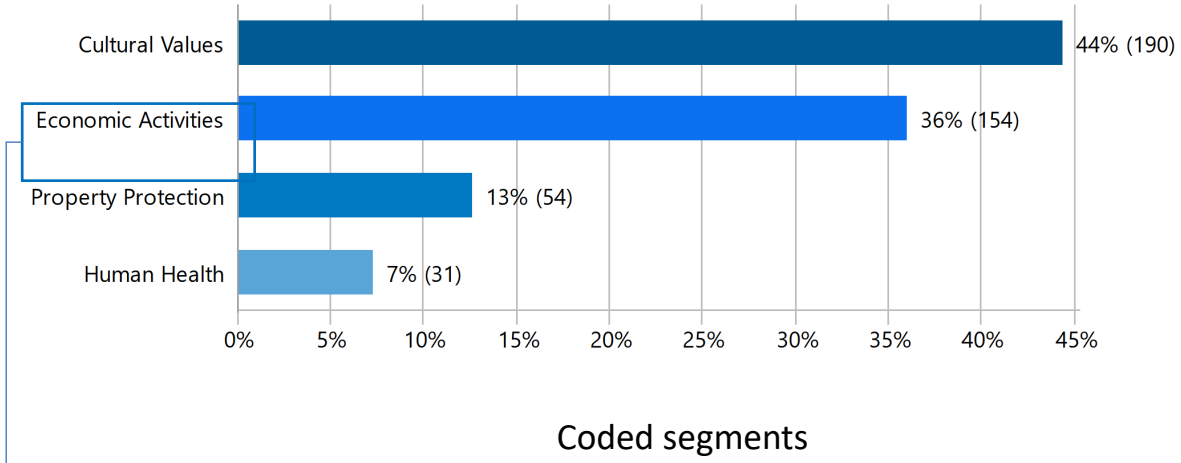
Environmental concerns reported by participants, were over 50% of respondents report being “very concerned” for:

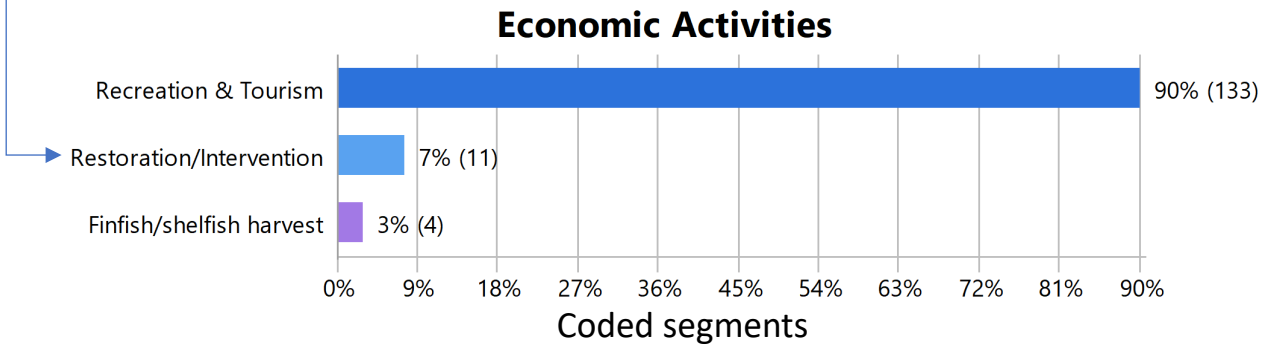
- Erosion of shoreline (57%)
- Severe storms (52%)

- Closely behind at 48%
  - Water quality
  - Loss of access of ability to use natural areas



Evidence of SE Outcomes: Galveston Bay





Cultural values

Reported knowledge of restoration/project.

Cultural uses

Engagement in volunteer activity end education

Economic Activities:

Report use of area for recreational activity.

Comments related to use of area for tourism or work or business

Property protection

Concern for erosion

Human Health

Food security

Use for solitude

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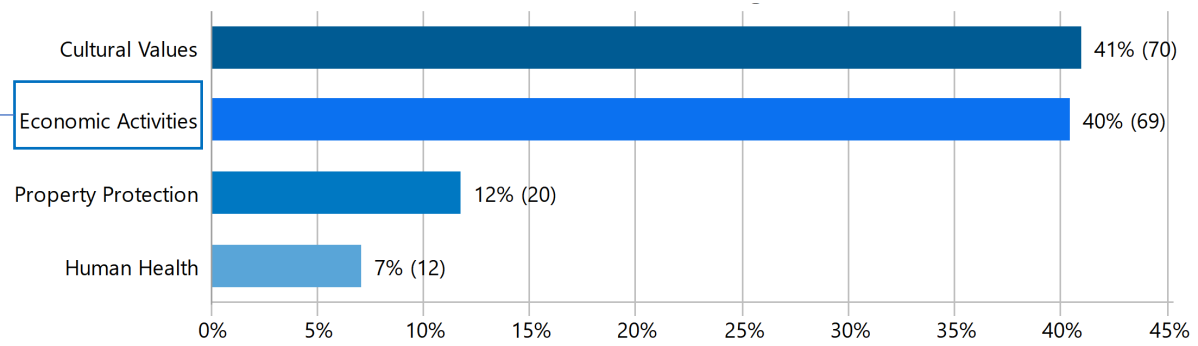
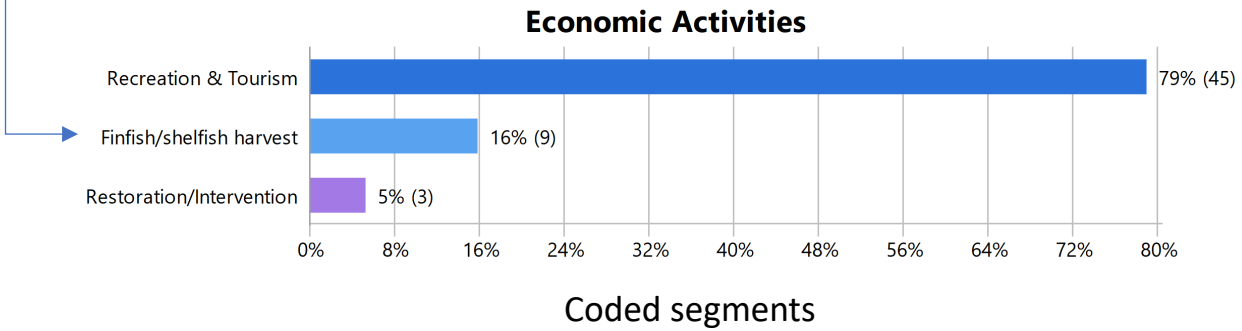
Evidence of SE Outcomes: Calcasieu Lake





Cultural values

Reported knowledge of restoration/project

Academic research' citizen science; outreach; social gatherings

Economic Activities:

Use of the area for fishing; reported jobs in commercial fishing industry; reported recreational activity

Property protection

Concern for erosion

Human Health

Reported use of nearby area of subsistence fishing; use for area for solitude

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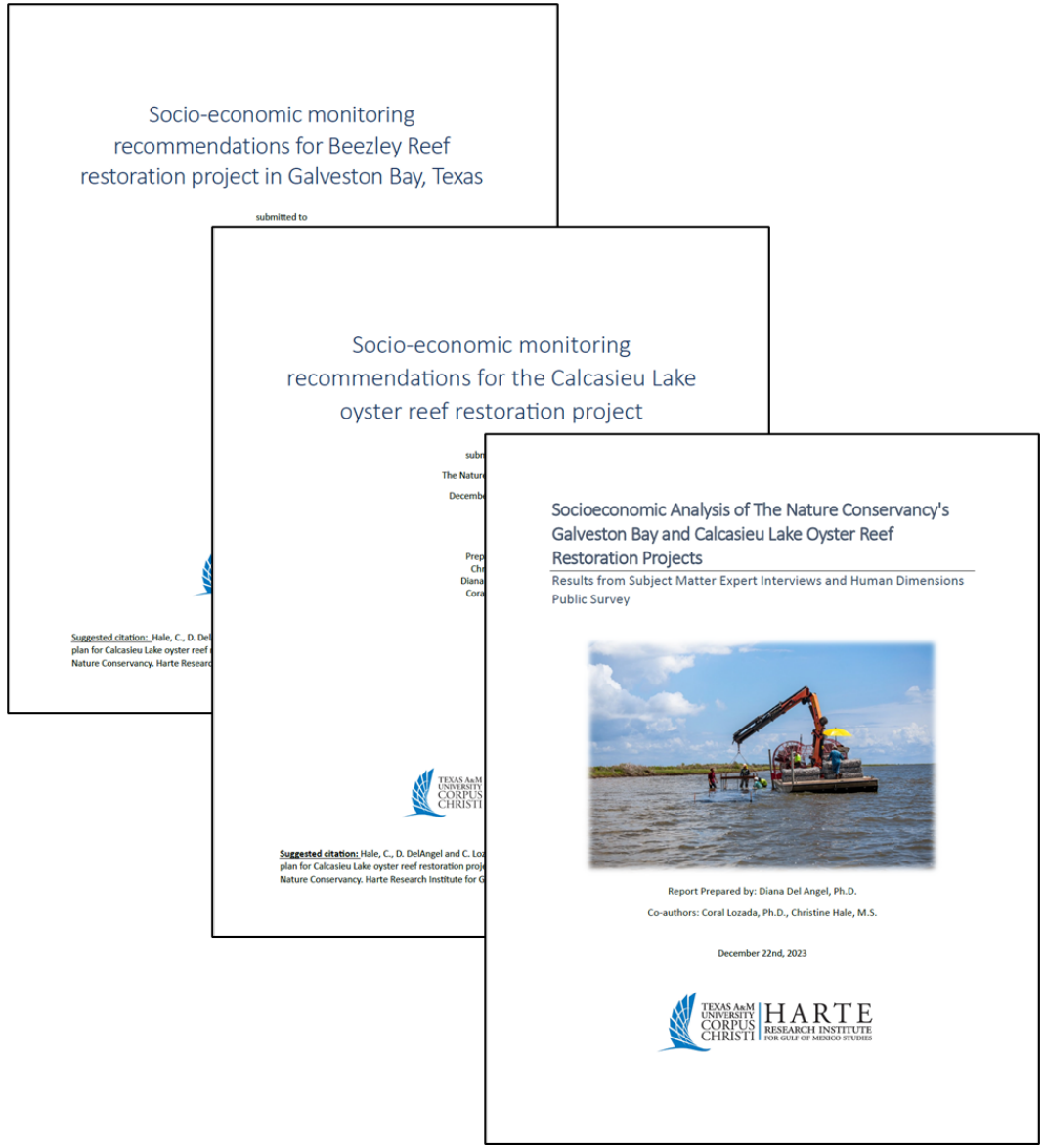
Project Outcomes:

- We utilized available Ecosystem Service Logic Models to identify potential socioeconomic outcomes of oyster reef restoration at two TNC Oyster Reef Restoration sites
- Expert interviews helped inform the development and deployment of the public survey
- The study captured public knowledge and sentiment regarding this projects
- Evidence of linkages form expert interviews and public survey were used to develop a socioeconomic monitoring plan for each site.



Limitations & Lessons Learned

- Given the dual purpose of the study the public survey was longer than is recommended.
- Survey was live for one-month. A longer collection period is recommended.
- The online paid advertisement resulted in more survey responses than flyers placed in strategic locations.


Photo Credit: TNC

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Thank you!

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https://www.harteresearch.org/research/community-resilience