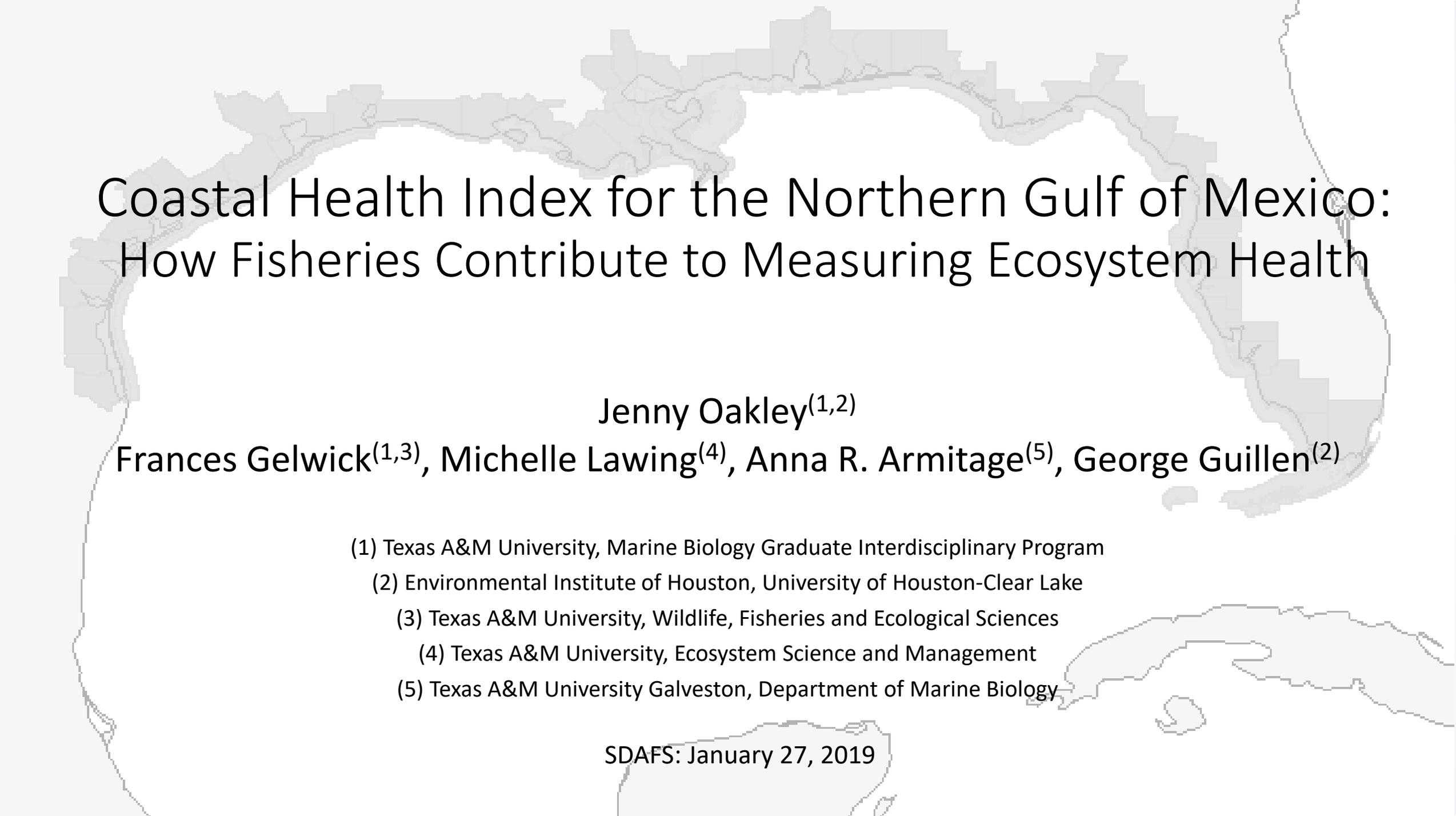


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Coastal Health Index for the Northern Gulf of Mexico: How Fisheries Contribute to Measuring Ecosystem Health

Jenny Oakley^(1,2)

Frances Gelwick^(1,3), Michelle Lawing⁽⁴⁾, Anna R. Armitage⁽⁵⁾, George Guillen⁽²⁾

(1) Texas A&M University, Marine Biology Graduate Interdisciplinary Program

(2) Environmental Institute of Houston, University of Houston-Clear Lake

(3) Texas A&M University, Wildlife, Fisheries and Ecological Sciences

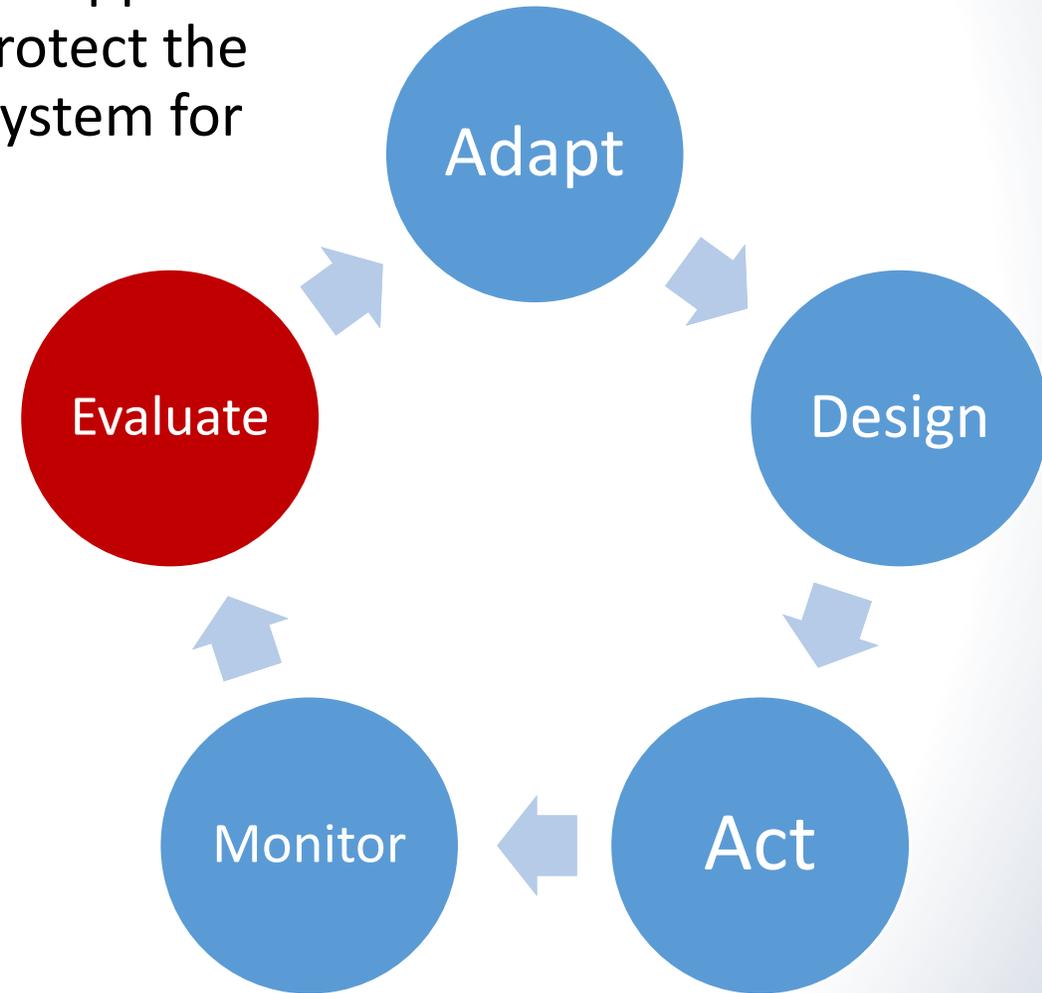
(4) Texas A&M University, Ecosystem Science and Management

(5) Texas A&M University Galveston, Department of Marine Biology

SDAFS: January 27, 2019

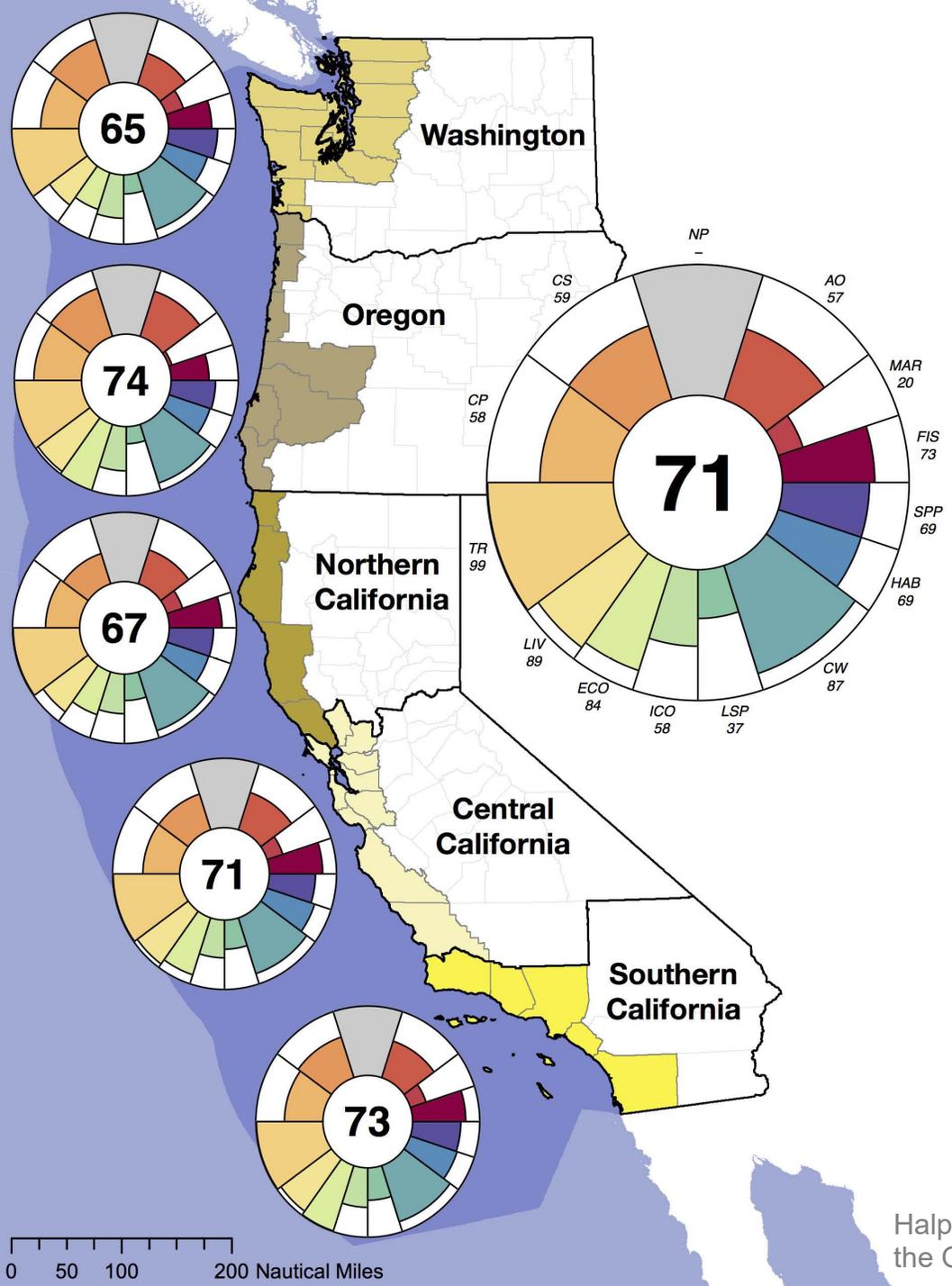
Background

- Ecosystem Based Management: site specific approach to natural resource management that aims to protect the health, function and resilience of an entire ecosystem for the benefit of all organisms.
- Integrate Metrics:
 - Biological
 - Chemical
 - Remotely Sensed
 - Economic
 - Societal



Regional Health Indices

- Ecosystem-based management
- Raise public awareness
- Identify knowledge gaps
- Prioritize management & research



Halpern BS,, et al. (2014) Assessing the Health of the U.S. West Coast with a Regional-Scale Application of the Ocean Health Index. PLoS ONE 9(6): e98995. doi:10.1371/journal.pone.0098995

Variable	Sub-variable	Definition
Food Provision (FP)	Fisheries (FIS)	Harvest of sustainably caught wild seafood
	Mariculture (MAR)	Production of sustainably cultured seafood
Artisanal Fishing (AO)		Opportunity to engage in artisanal-scale fishing for subsistence or and/or recreation
Natural Products (NP)		Sustainable harvest of sustainable and renewable natural products other than food provision
Carbon Storage (CS)		Status of natural habitats affording long-lasting carbon storage

$$CHI = a_1V_1 + a_2V_2 + \dots + a_{10}V_{10} = \sum_{i=1}^{10} a_iV_i$$

Coastal Protection (CP)		Status of natural habitats affording protection of the coast
Tourism and Recreation (TR)		Opportunity to enjoy coastal areas for recreation and tourism
Coastal Livelihoods and Economies (LE)		Jobs and wages from marine-related sectors
Coastal Economies (ECO)		Revenues from marine-related sectors
Lasting Special Places (LSP)		Cultural, or aesthetic connection to the environment afforded by coastal and marine places of significance
Sense of place (SP)	Iconic Species (ICO)	Cultural or aesthetic connection to the environmental afforded by iconic species
Clean Waters (CW)		Clean waters that are free of nutrient and chemical pollution
Biodiversity (BD)	Habitats (HAB)	The existence of value of biodiversity measured through the conservation status of habitats
	Species (SPP)	The existence value of biodiversity measured through the conservation status of marine-associated species

Stakeholder Survey

- Social Media  
- Targeted E-mail
- Survey
 - Value importance when determining if a coastal ecosystem is healthy
 - Likert Scale
 - Differentially weight model



Do you live, work, or vacation along the Texas Gulf Coast?
Please take a short survey on the health of your coast.

<https://www.surveymonkey.com/r/TexasGulfCoast>

Study Area

Ocean and Coastal Management 154 (2018) 1–7

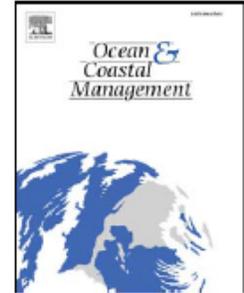


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journal homepage: www.elsevier.com/locate/ocecoaman



Defining ecologically, geographically, and politically coherent boundaries for the Northern Gulf of Mexico coastal region: Facilitating ecosystem-based management



Jenny W. Oakley^{a,b,*}, A. Michelle Lawing^c, George J. Guillen^b, Frances Gelwick^{a,d}

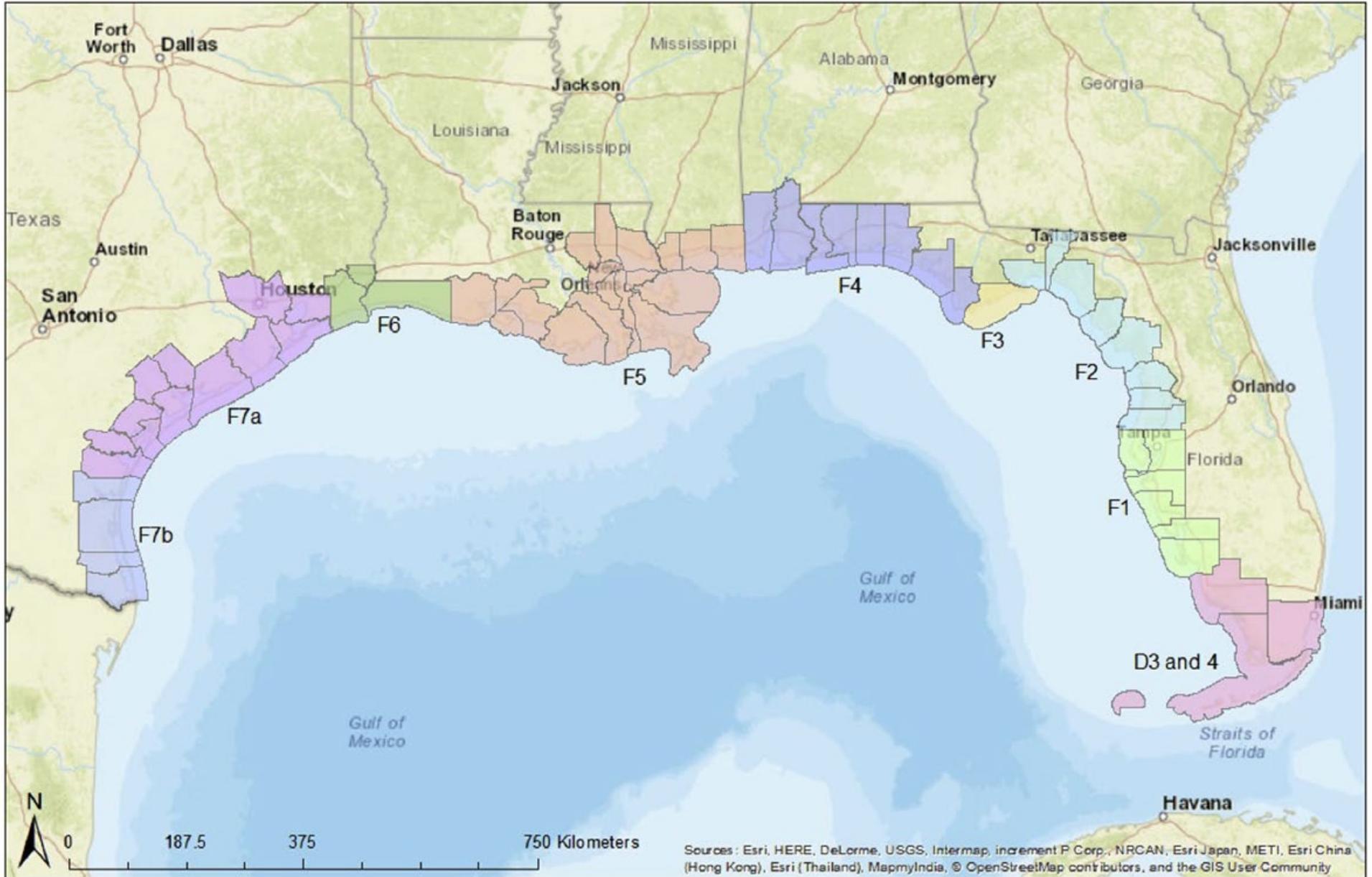
^a Texas A&M University, Marine Biology Graduate Interdisciplinary Program, 100 Butler Hall, 3258 TAMU, College Station, TX 77843, USA

^b Environmental Institute of Houston, University of Houston-Clear Lake, 2700 Bay Area Blvd, Houston, TX 77058, USA

^c Texas A&M University, Ecosystem Science and Management, 534 John Kimbrough Blvd., 2138 TAMU, College Station, TX 77843, USA

^d Texas A&M University, Wildlife, Fisheries and Ecological Sciences, 534 John Kimbrough Blvd, 2258 TAMU, College Station, TX 77843, USA

Study Area



Food Provision

- Fisheries

- Harvest of wild-caught seafood

- Commercial landings by species

- Fishery Sustainability Score (FSS) ← resiliency and vulnerability

- Data Source: State Resource Agencies

- Reference Point – Relative Target

- All species harvested with high resilience and low vulnerability scores.

- Mariculture

- Harvest of farm-raised seafood

- Data Source: USDA – Agriculture Census

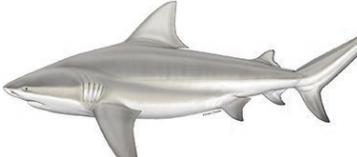
- Reference Point – Established Target

- Aquaculture supports increasing demand for seafood sustainably

Musick, J.A. (1999) Criteria to Define Extinction Risk in Marine Fishes. Fisheries 24(12): 6-14

Cheung, et al. (2005) A fuzzy logic expert system to estimate intrinsic extinction vulnerabilities of marine fishes to fishing. Biological Conservation 124: 97-111

FSS Examples

	Common Name*	Species	Resilience**	Vulnerability	FSS
	Bull shark	<i>Carcharhinus leucas</i>	Very Low	88	18.5
	Red snapper	<i>Lutjanus campechanus</i>	Low	55	47.5
	Southern flounder	<i>Paralichthys lethostigma</i>	Medium	44	65.5
	Atlantic Thread Herring	<i>Opisthonema oglinum</i>	Medium	24	75.5
	Eastern oyster	<i>Crassostrea virginica</i>	High	27	86.5
	Blue crab	<i>Callinectes sapidus</i>	High	13	93.5
	Stone crab	<i>Menippe spp.</i>	High	10	95.0

* 165 species commercially harvested in study area

**Resilience Metric: very low = 1, low = 2, medium = 3, high = 4

Artisanal Fishing Opportunity

- Opportunity to engage in artisanal-scale fishing for subsistence or recreation.
 - Contaminant levels
 - Metals (Arsenic and Mercury)
 - Pesticides (DDTs, Dieldrin and Mirex)
 - PCBs
 - Number of designated access points per impoverished population.
 - Proportion of designated access points free of charge
- Data Source: EPA NCCA , US Census, NOAA Pub. Access Register
- Reference Point - Relative Target
 - All fish are free of contaminants, and there is at least 1 designated access point available, free of charge, for every 500 people in poverty.

Tourism and Recreation

- Tourism-related jobs and economy

- Establishments
- Employment rate
- Wages paid → Annual salary
- GDP

$$TR\ Score = \left(\frac{TR_i}{T_i}\right) / \left(\frac{TR_j}{T_j}\right)$$

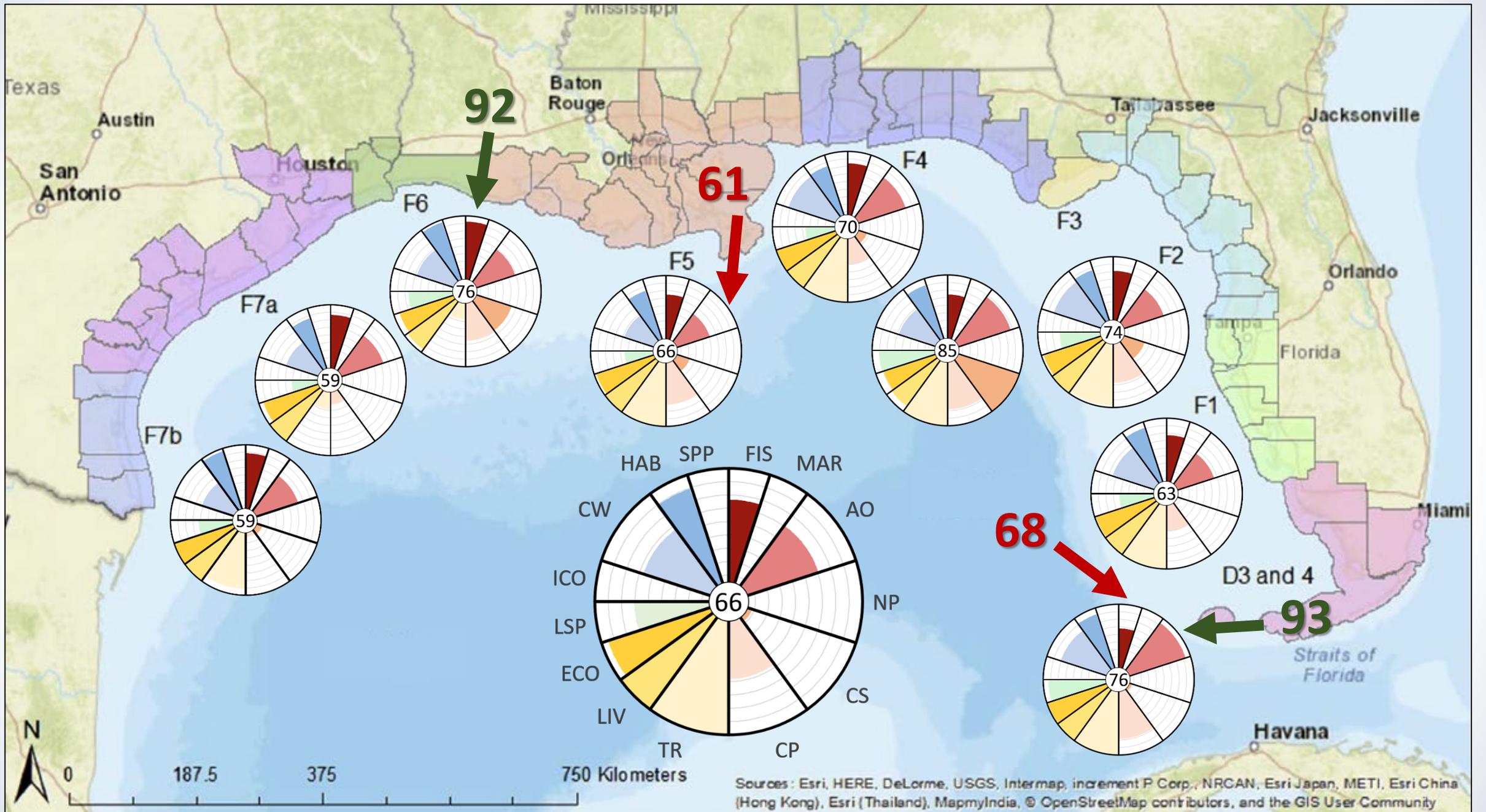
i = Region

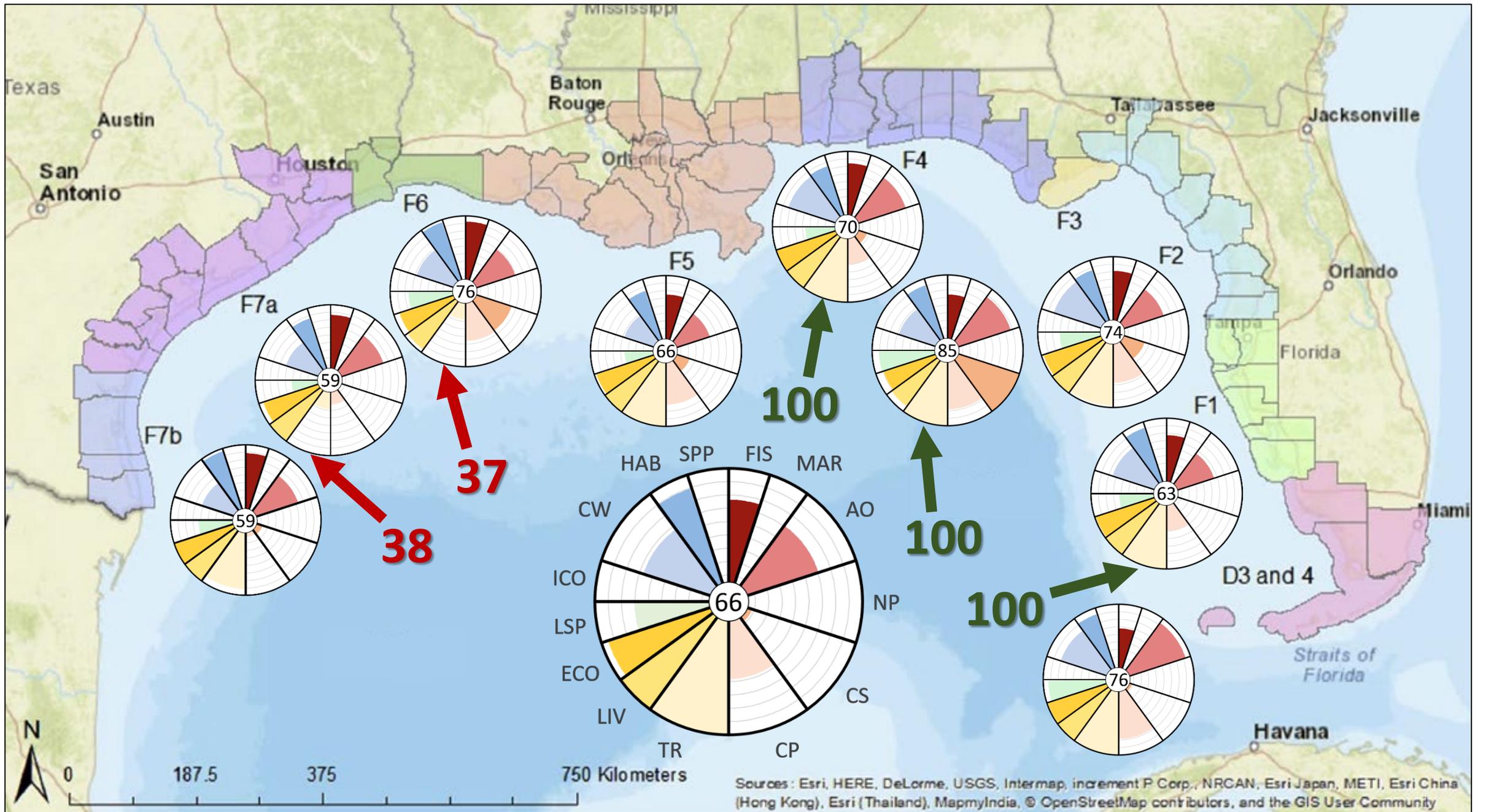
j = National-Coastal

- Data Source: NOAA Economics: National Ocean Watch

- Reference Point: Moving Target

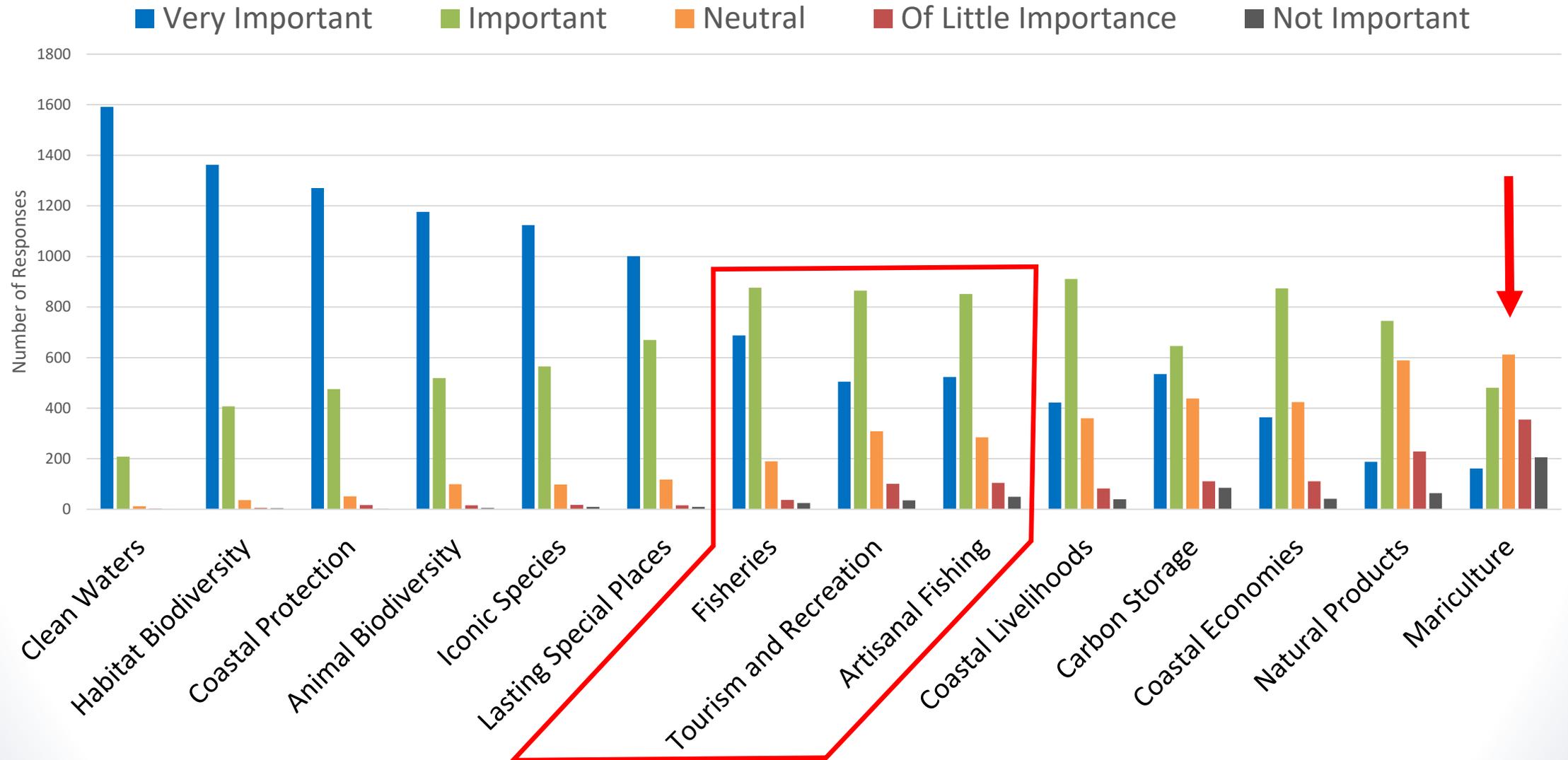
- Regional Tourism and Recreation sector compared to the regional total economy keeps pace with National (coastal)
- 5 year moving average





Stakeholder Survey

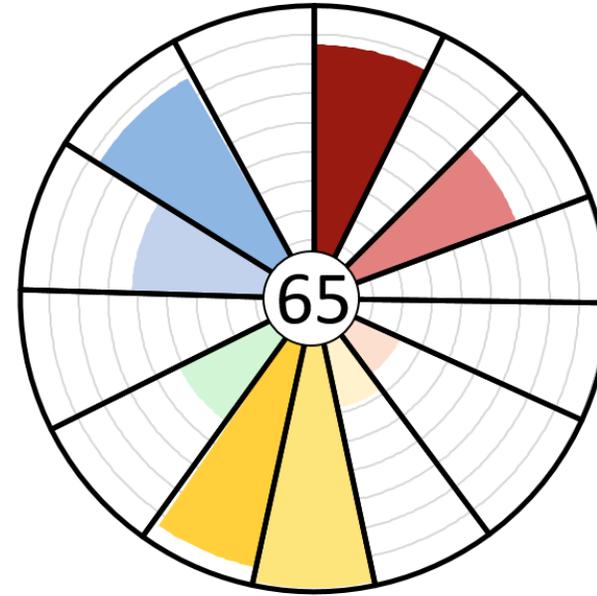
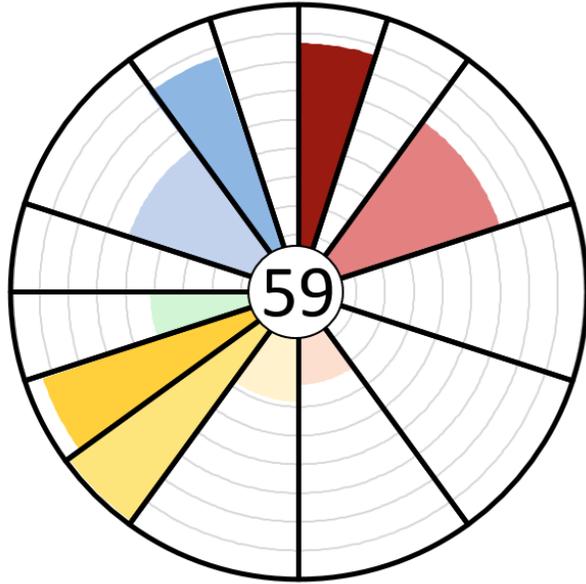
- 2,265 responses = 1,815 complete



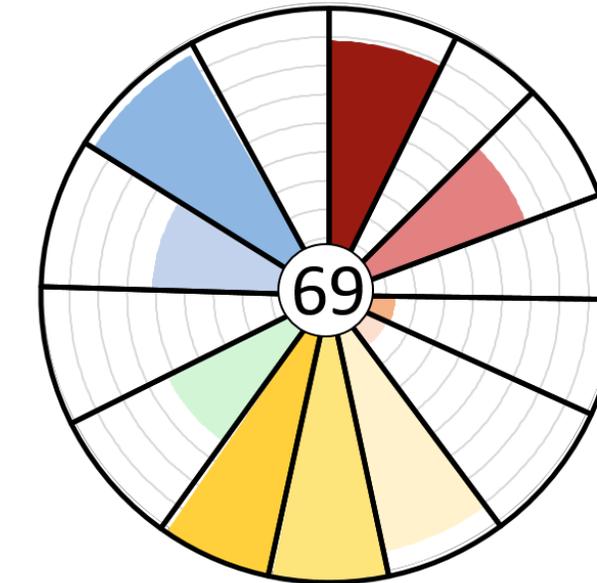
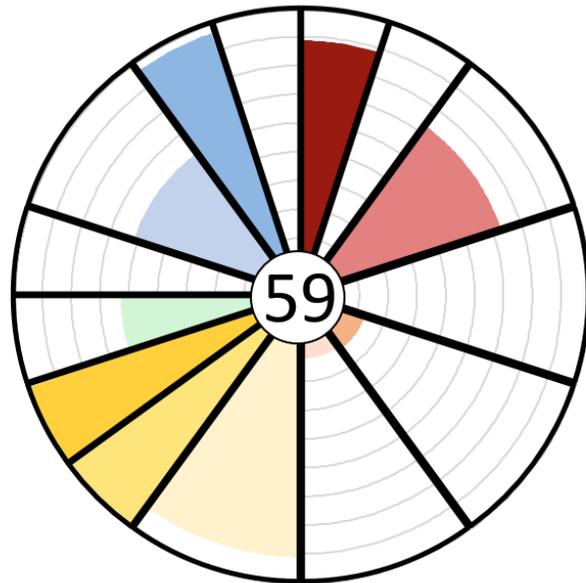
Original Model

Differentially Weighted

F7a



F7b



Variables
Fisheries
Mariculture
Artisanal fishing
Natural Products
Carbon Storage
Coastal Protection
Tourism and recreation
Coastal livelihoods
Coastal economies
Lasting Special Places
Iconic Species
Clean Waters
Biodiversity of Habitats
Biodiversity of Species

Acknowledgements

- Data Sources and Data Managers

- NOAA (C-CAP, ENOW)
- EPA (NCCA)
- State Resource Agencies (TPWD, LDWF, MDWFP, ADCNR, FWC)
- USDA (NASS)
- USGS (PAD)
- Nature Serve
- Jones and Kammen (2014)
- US Department of Labor (BLS)
- IUCN

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- Texas A&M University, Wildlife and Fishery Science
- University of Houston-Clear Lake, and EIH
- Texas Chapter of the American Fisheries Society



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A serene sunset scene over a marina. The sky transitions from a deep orange near the horizon to a dark, clear blue at the top. In the foreground, the dark silhouettes of a boat and its mast are visible on the left. The water in the foreground is calm, reflecting the warm colors of the sunset. In the background, numerous masts of other boats are visible against the bright orange glow of the setting sun. The overall mood is peaceful and reflective.

Thank You

Jenny Oakley
jwoakley@tamu.edu