ECOSYSTEM HEALTH ASSESSMENT FOR THE COASTAL GULF OF MEXICO: OPPORTUNITIES FOR DOWNSCALING TO GALVESTON BAY
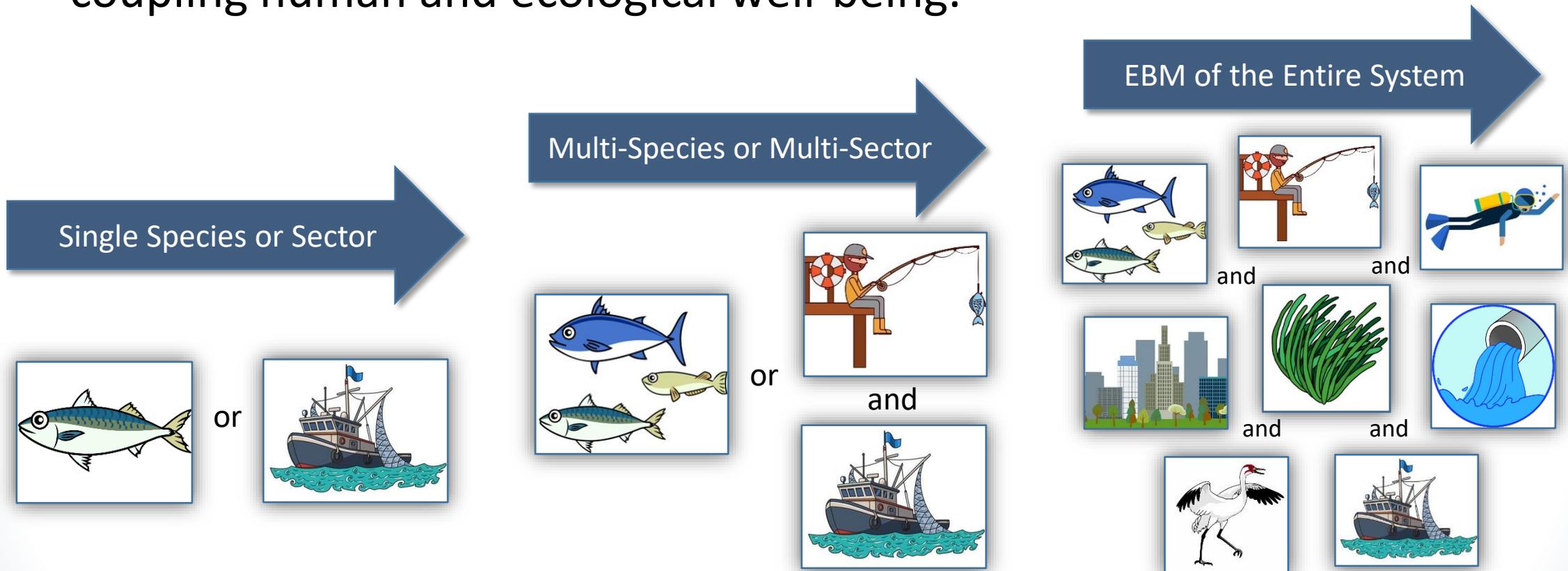
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Background

- <u>Ecosystem-Based Management:</u> Site specific approach that aims to protect the health, function and resilience of an entire ecosystem, coupling human and ecological well-being.

Single Species or Sector

Multi-Species or Multi-Sector

EBM of the Entire System

or

or

and
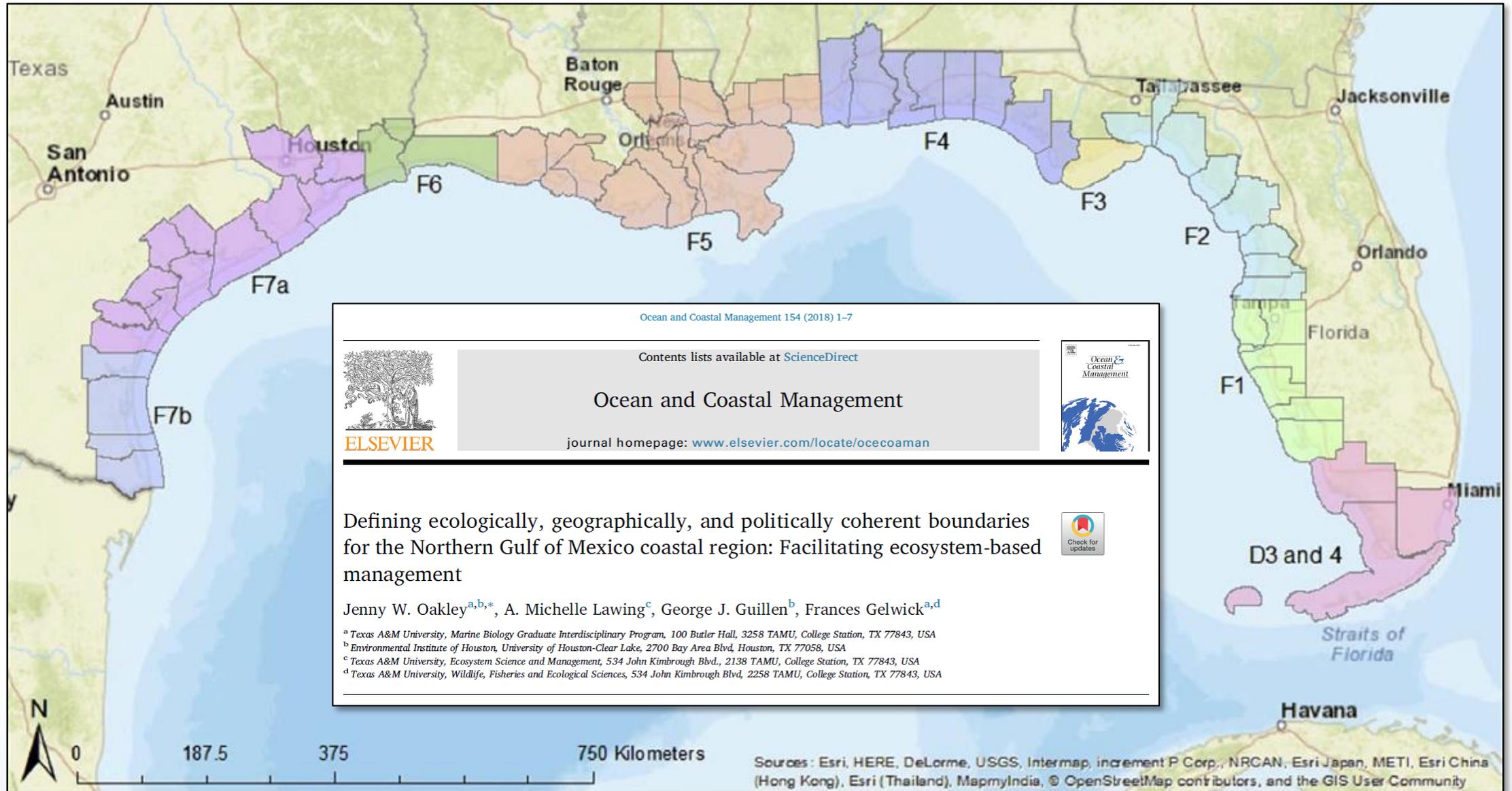
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Background

- Adaptive Management Framework:

- Integrate Metrics:
  - Biological
  - Chemical
  - Economic
  - Societal
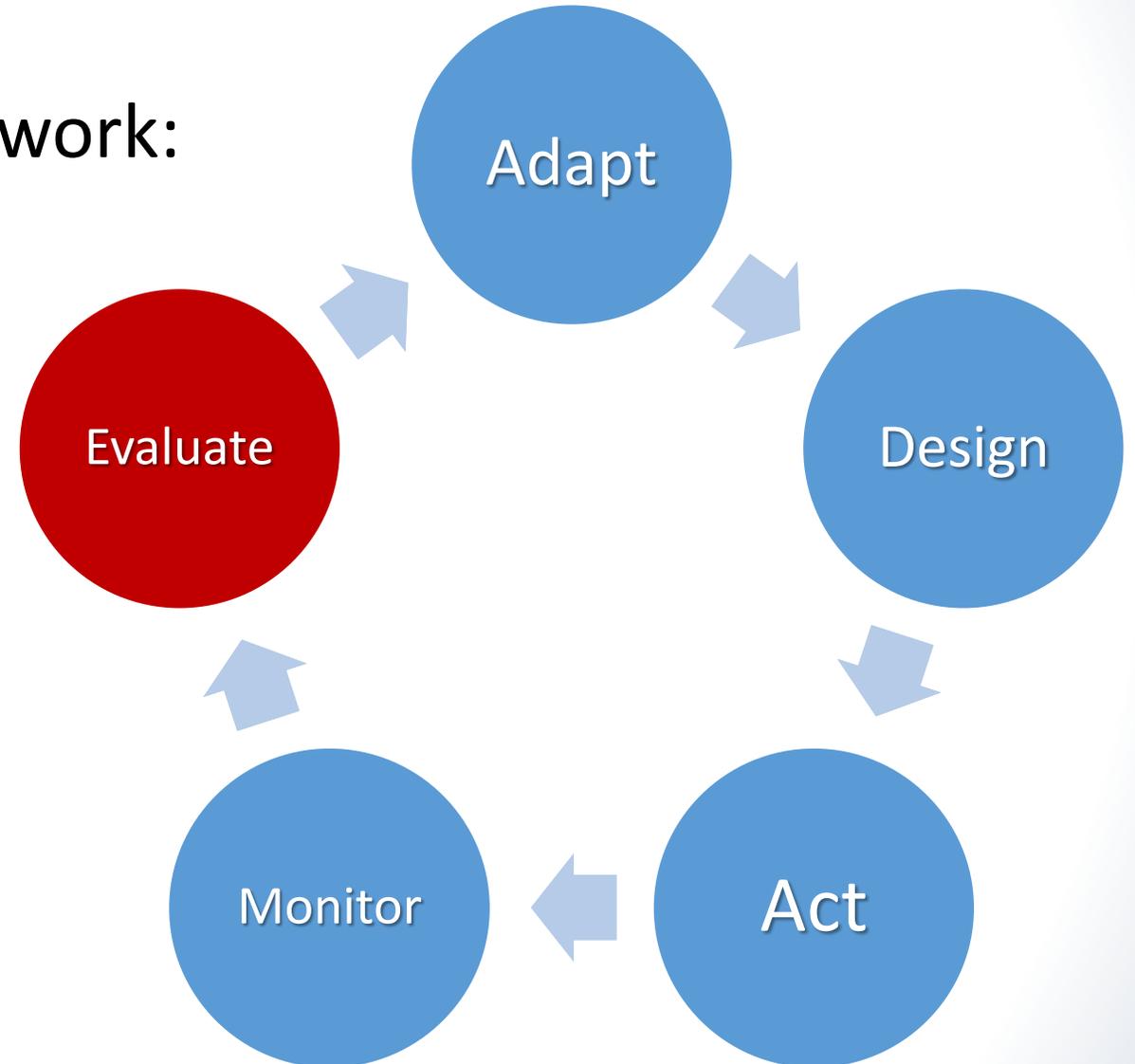
# Study Area

Coastal Health Index Methods

| Variables	Sub-Variables	Definition
Food Provision (FP)	Fisheries (FIS)	Harvest of sustainabily caught seafood
	Aquaculture (AQA)	Production of sustainably-cultured aquatic food
Artisanal Fishing (AO)		Opportunity to engage in artisanal-scale fishing for subsistence
Natural Products (NP)		Sustainable harvest of renewable natural products other than food provision
Carbon Storage (CS)		Potential of natural habitats to afford long-lasting carbon storage
Coastal Protection (CP)		Status of natural habitats affording protection of the coast
Tourism and Recreation (TR)		Economic stability of recreation and tourism supported by a healthy coast
Coastal Livelihoods and Economies (LE)	Coastal livelihoods (LIV)	Jobs and wages from marine-related sectors
	Coastal economies (ECO)	Revenues and Establishments from marine-related sectors
Sense of Place (SP)	Lasting Special Places (LSP)	Cultural or aesthetic connection to the environment afforded by protected places
	Iconic Species (ICO)	Cultural or aesthetic connection to the environment afforded by iconic species
Clean Waters (CW)		Clean waters that meet basic aquatic life use standards
Biodiversity (BD)	Biodiversity of Habitats (HAB)	The existence of biodiversity afforded by the conservation status of habitats
	Biodiversity of Species (SPP)	The existence of biodiversity afforded by the conservation status of coastal species

$$CHI = a_1 V_1 + a_2 V_2 + \cdots + a_{10} V_{10}$$

Sub-Variables	Data Source(s)	Data Used
Fisheries	Gulf States Fishery Management Agencies	Annual commercial catch (in lbs/year) per species
Aquaculture	USDA Agriculture Census	Annual aquaculture produced (in lbs/year) by type
Artisanal Fishing	NOAA, Public access fishing site register; U.S. Census, SAIPE; EPA, NCCA	Designated access points and if they charge an access fee; Number of people in poverty; Wild-caught seafood contaminants
Natural Products	Not applicable	Insufficient data/products available for analysis
Carbon Storage	NOAA, CCAP; Jones and Kammen 2012; Literature Review	Aerial cover by habitat type; Total carbon footprint (tCO2e/yr); Carbon storage potential by habitat type (gC/m2/yr)
Coastal Protection	NOAA, CCAP	% cover of wetland habitats compared to wetland potential
Tourism and Recreation	NOAA, ENOW	Tourism and Recreation sector of total ocean economy; Total coastal economy
Coastal Livelihoods	NOAA, ENOW	Total ocean economy; Total economy
Coastal Economies	NOAA, ENOW	Total ocean economy; Total economy
Lasting Special Places	NOAA,CCAP; USGS, PAD	Coverage by habitat type; Coverage of protected land and level of protection
Iconic Species	IUCN	Conservation status by species
Clean Waters	EPA, NCCA	Nutrients, Chlorophyll-a, Dissolved Oxygen, Water Clarity
Biodiversity of Habitats	NOAA, CCAP; USGS, PAD	Coverage by habitat type; Coverage of protected land and level of protection
Biodiversity of Species	IUCN; NatureServe	Conservation status by species

Coastal Health Index – Northern Gulf of Mexico

- Overall CHI 70/100

- Lowest scoring variable
  - Carbon Storage (18)

- Highest scoring variable
  - Coastal Livelihoods (97)
  - Coastal Economies (92)
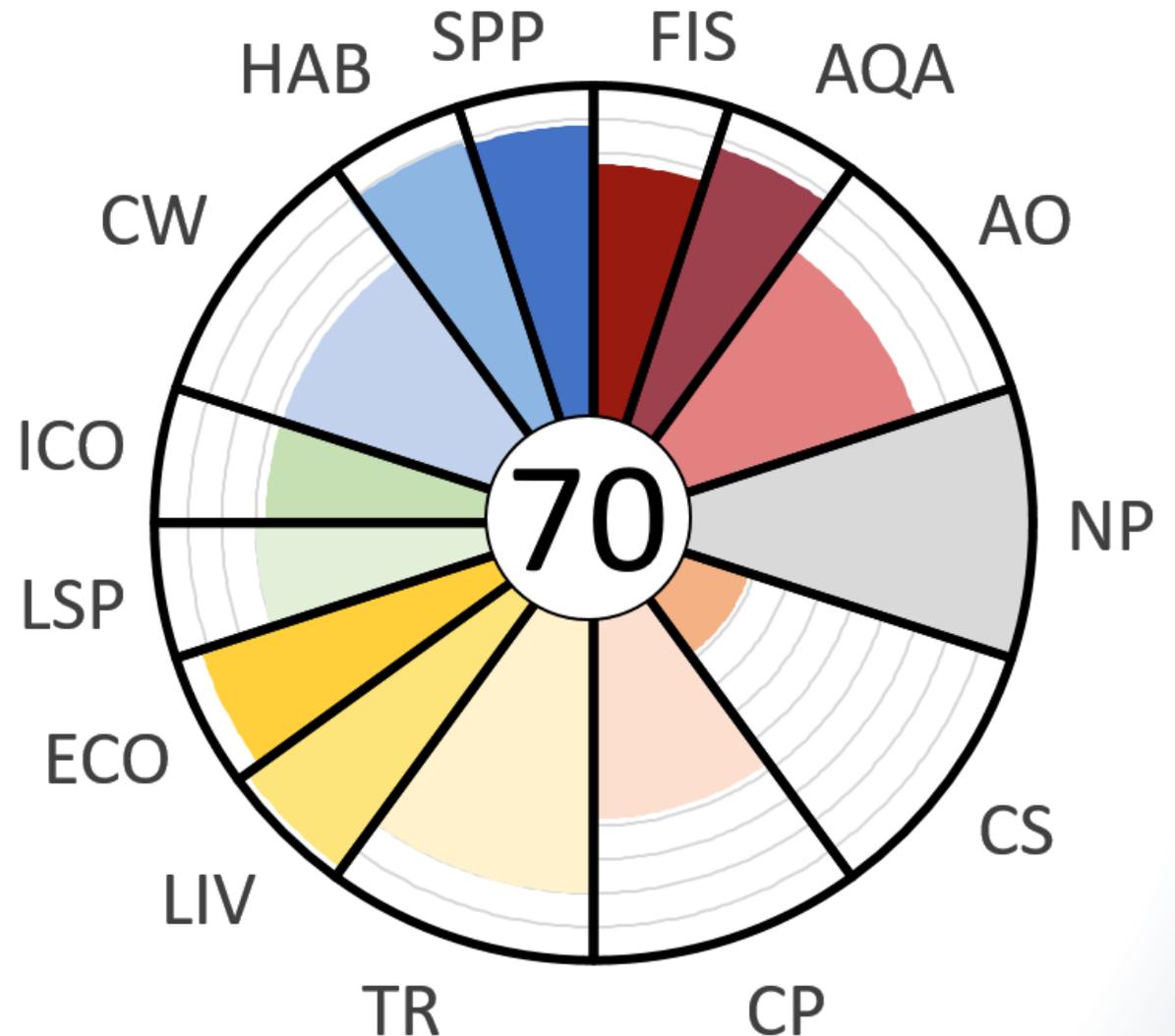
Coastal Health Index
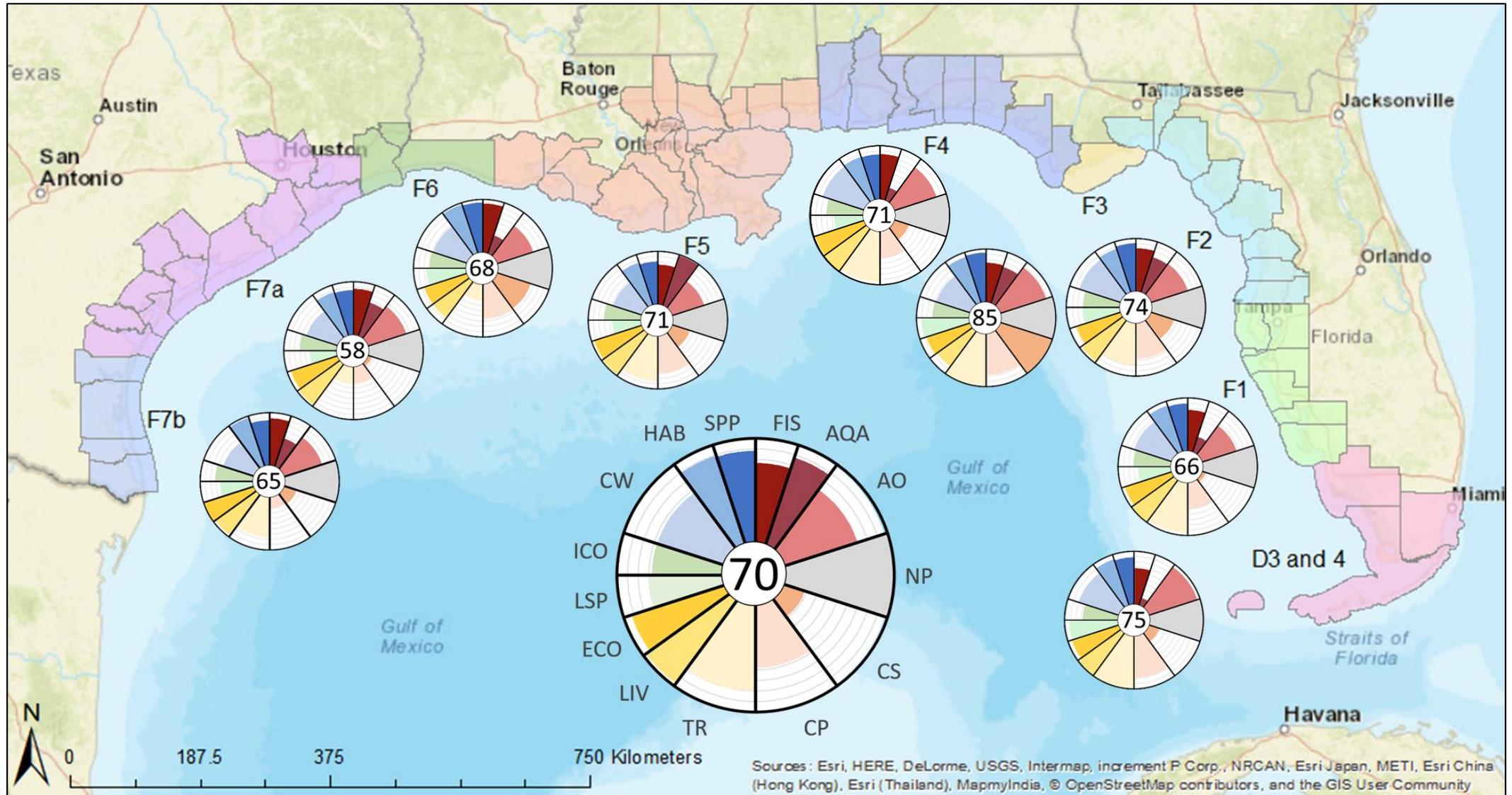
Discussion - CHI

- CHI for the Gulf Coast is 70 (58 for F7a)

  - How does that compare to other indices?

    - OHI for U.S. = 69   (Halpern et al. 2015)

    - OHI for West Coast = 71   (Halpern et al. 2014)

    - TX Coast Report Card = B- (HRI 2019)

    - Galveston Bay Report Card = C (GBF/HARC 2019)

  - Use caution when making comparisons

    - Different: spatial scales, data sources, and metrics

Halpern, B. 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
Halpern, B. et al. (2015) Patterns and Emerging Trends in Global Ocean Health. PLOS ONE 10(3):10.1371/journal.pone.0117863
(HRI) Harte Research Institute for Gulf of Mexico Studies. 2019. Texas Ecosystem Health Report Card.
(GBF/HARC) Galveston Bay Foundation and Houston Advanced Research Center. 2019. Galveston Bay Report Card https://www.galvbaygrade.org/.

Discussion - CHI

- Heterogeneous scores among variables and regions

- Room for improvement – research/management focus

- Historical data: individual metrics and some variables

- Detailed and quantifiable metrics
  - Reproducible index
  - Capable of measuring slight changes
  - Wide range of ecosystem services

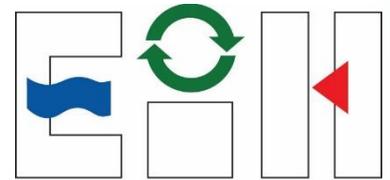- Benchmark to measure ecosystem health

Future Work

- Re-calculation with updated data
  - Potential trends
  - Measure response to management actions or human/environmental stressors

- Expand survey to entire Gulf Coast
  - Stakeholder values differ spatially?

- Work to fill in knowledge gaps

- Scale-down CHI to individual estuaries – Galveston Bay

- Scale-up to entire Gulf of Mexico

Acknowledgements

- My Committee: Drs. Gelwick, Guillen, Lawing, and Armitage
- Data sources and data managers
  - EPA (NCCA)
  - IUCN
  - Jones and Kammen (2014)
  - NatureServe
  - NOAA (C-CAP, ENOW)
  - State Resource Agencies (TPWD, LDWF, MDWFP, ADCNR, FWC)
  - US Department of Labor (BLS)
  - USDA (NASS)
  - USGS (PAD)
- Texas stakeholders - 2,265 survey respondents
- Financial support
  - Texas A&M University, Marine Biology Interdisciplinary Program
  - Texas A&M University, Wildlife and Fisheries Sciences
  - University of Houston-Clear Lake, and EIH
  - Texas Chapter of the American Fisheries Society