

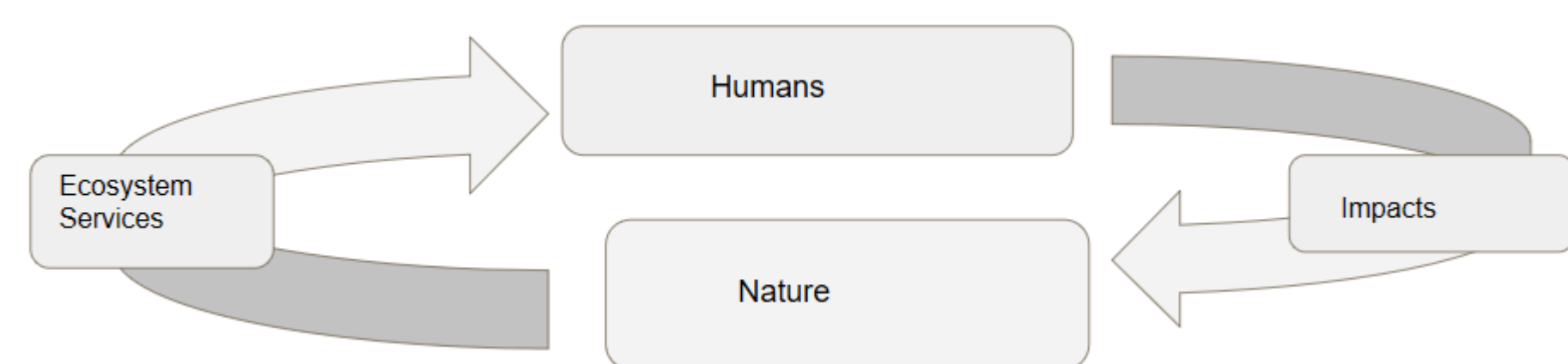
The Impacts of Shifting Species Distributions on Estuarine Ecosystems in the Big Bend Region of Florida

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“It is not the strongest of the species that survives, nor the most intelligent. It is the one that is most adaptable to change.” - Charles Darwin

Background

- Estuaries provide nursery or spawning habitat for the majority of commercially significant marine fish species within the U.S.
- Global temperatures have increased by 1° C since the industrial revolution, and are expected to increase by 2-3° C by 2100.¹
- On average, marine species are moving poleward 72 km per decade as a result of increasing temperatures.²
- Species are shifting at varying rates creating novel interactions
- Florida’s economy is based on primarily on tourism and agriculture. It is directly affected by ecosystem goods & services.
- Relationship between people and ecosystems is bidirectional. Humans depend on the goods and services provided by ecosystems and those supplies are affected by human activities.

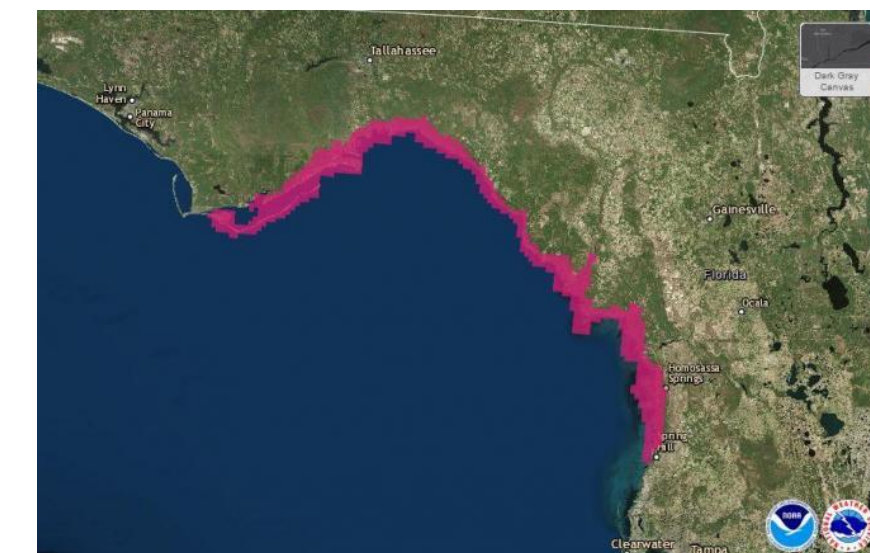


- The combination of human-induced pressure like tourism and fishing combined with the uncertainties related to climate change makes ecosystems more vulnerable to management decisions.
- Policies regarding ecosystem management must be flexible and responsive to ensure the relationship between humans and ecosystems is sustainable in light of the uncertainties associated with climate change.

Thus, our goal is to determine how shifting distributions of plants and animals likely influence estuarine communities and the fisheries supported by these systems.

Cedar Key: A Case Study

- Cedar Key and the Big Bend Region as a whole comprises important, relatively pristine Class II Waters and estuaries. It’s the least developed coastline in the State.



- Species distributions within the region are shifting poleward leading to a topicalization of the region
 - Red mangroves (*Rhizophora mangle*) are increasing in abundance
 - Roseate spoonbills (*Platalea ajaja*) nested in Cedar Key for the first time in 2013³
 - Common Snook (*Centropomus undecimalis*) density increasing exponentially

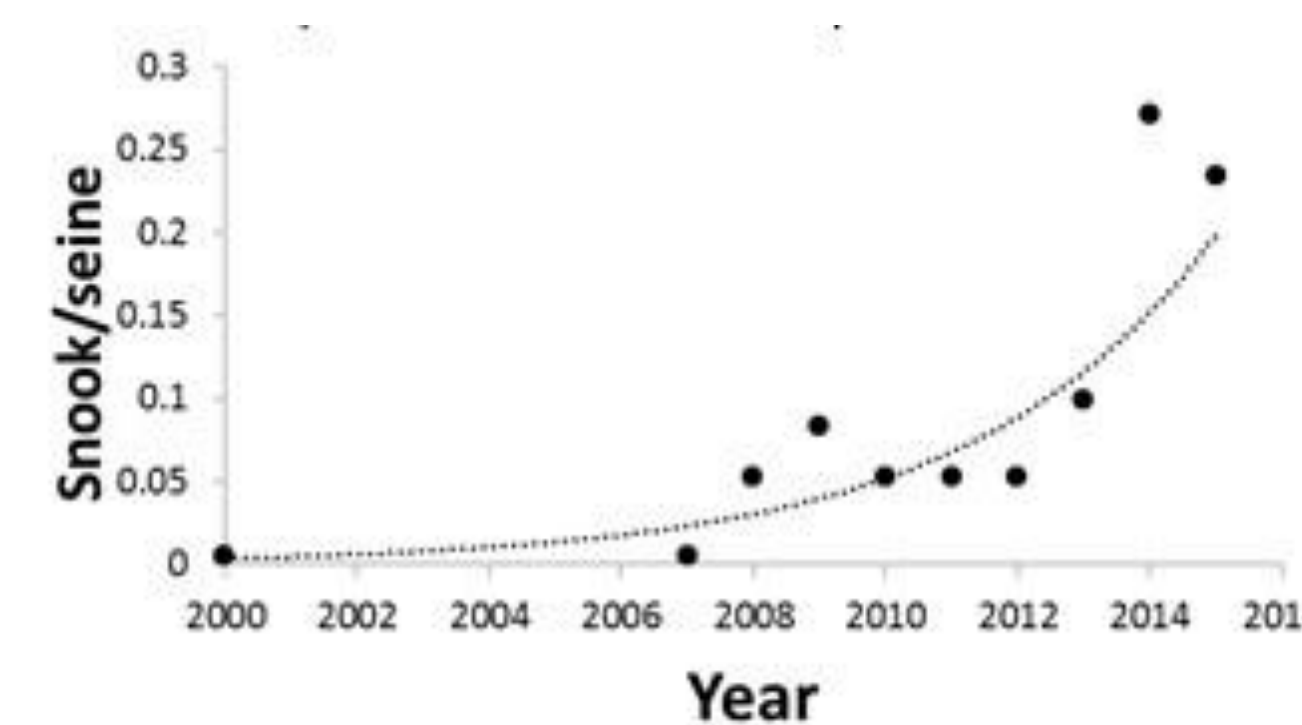


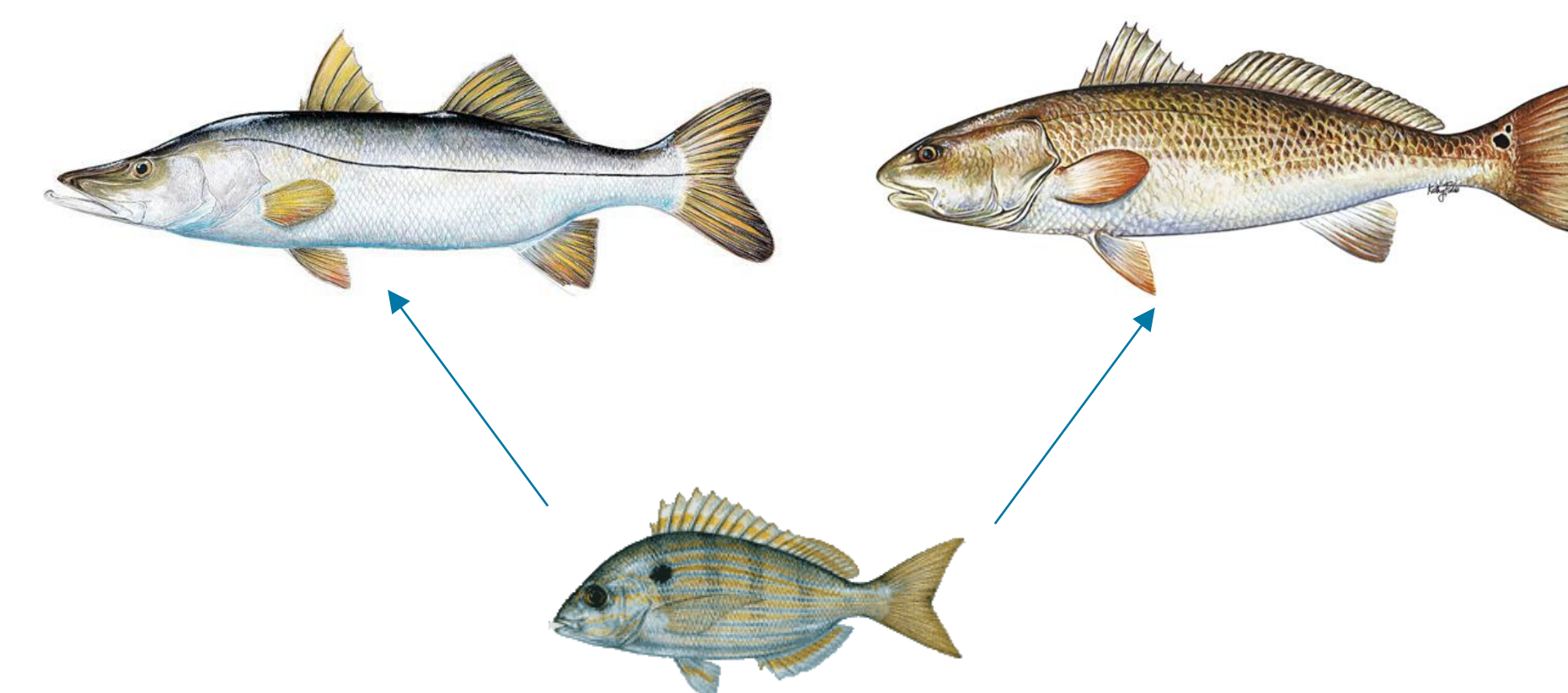
Figure 2. Data from monthly Florida Fish and Wildlife Research Institute Fisheries Independent Monitoring 183-m seines (n= 192 each year) indicate Snook density has increased exponentially since 2000 in Cedar Key, FL.

- Cedar Key has a rich culture and history of resiliency so long as genuine stakeholder participation remains in decision-making process for ecosystem management, future policy outcomes will reflect the innovation and adaptability of the community.

Conclusions

WHAT WE EXPECT

- The exponential increase in Snook abundance may decrease the abundance of other species through predator-prey interactions
 - Small fish
 - Bait shrimp
- Competition for prey resources between the Common Snook, Red Drum (*Sciaenops ocellatus*), and Spotted Seatrout (*Cynoscion nebulosus*) is expected as they rely on similar prey such as the Pinfish (*Lagodon rhomboides*) and gulf shrimp (*Farfantepenaeus duorarum*).



- We expect that the Common Snook, Red Drum, and Spotted Seatrout will coexist locally through resource partitioning
- The possibility of non-native species invasions and the impacts of freeze events introduce uncertainty into projections

Conclusions

HUMANS

- Increase in fishing and tourism pressure may result from changing distributions
- There is the potential for positive and negative impacts on the value of Florida’s economy
- Broad and diverse public participation that include relevant stakeholders and considers trade-offs in policy decisions is important in order to ensure effective management

POLICY

- Current policy may be appropriate, however the environment is changing rapidly, therefore, policy alternatives need to be considered.

Recommendations

- Research regarding the impacts of shifting distributions on community structure and function
- Harsher penalties and enforcement of laws pertaining to invasive species
- Ecosystem-based fisheries management
- Decision-making process of ecosystem management that is fair, accountable, & accessible
- Trophy fishing zones

Acknowledgments



Works Cited

- ¹ Morley, J.W., R.D. Batt, and M.L. Pinsky. 2016. Marine assemblages respond rapidly to winter climate variability. *Global change biology*.
² Poloczanska, E.S., C.J. Brown, W.J. Sydeman, W. Kiessling, D.S. Schoeman, P.J. Moore, K. Brander, J.F. Bruno, L.B. Buckley, and M.T. Burrows. 2013. Global imprint of climate change on marine life. *Nature Climate Change* 3: 919-925.
³ Seavey, J.R., P.C. Frederick, and V. Doig. 2014. Roseate Spoonbills (*Platalea ajaja*) Nesting on Seahorse Key, Cedar Keys National Wildlife Refuge, Levy County, Florida. *Florida Field Naturalist* 42: 61-63.