Socio-ecological Vulnerability of the Octopus Fishery in the Yucatan peninsula

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Introduction

- Fisheries systems can be susceptible to adverse effects and hence become vulnerable, accounting for exposure, sensitivity and adaptive capacity (Adger, 2006).
- The octopus fishery which targets two species (*Octopus maya* and *O. vulgaris)* is one of the most important fisheries in the southeast of Mexico (fig. 2a).
- *O. maya* is an endemic species, highly sensitive to changes in environmental conditions.
- The region is highly exposed to diverse phenomena, including hurricanes, that concur with the octopus fishing season.
- Vulnerability in the fishery can be outspread to the fishing sector and its users.

Objective: Define the socio-ecological vulnerability of the octopus fishery and the producers that depend on the resource accounting for environmental and social indicators.

Material and Methods

Ecological

Time series 1964 -2015:
Octopus catches
Environmental variables (EV)
- Sea surface temperature (SST)
- Total solar irradiance (TSI)
- Precipitation index (PI)
- Hurricane index (HI)

Sensitivity
GLM (Catch Index ~ EV)
Significant variables

Exposure
Tendency Overlap (D)
(Catch ~ EV)
Niche overlap modified (Schoener 1968)

Adaptive capacity
Resilience
Intrinsic rate of population growth (r) ~ EV

Social

Interviews to three target groups of fishers from Sisal, Yucatan:
- Independent fishers
- Cooperative fishers
- Firm owners

NMDS and Permanova

Sensitivity
Risk perception to operational and climatic factors

Exposure
Dependence on the resource
Exposure of assets to climatic factors

Adaptive capacity
Coping strategies to Socioeconomic and climatic factors

Integration:
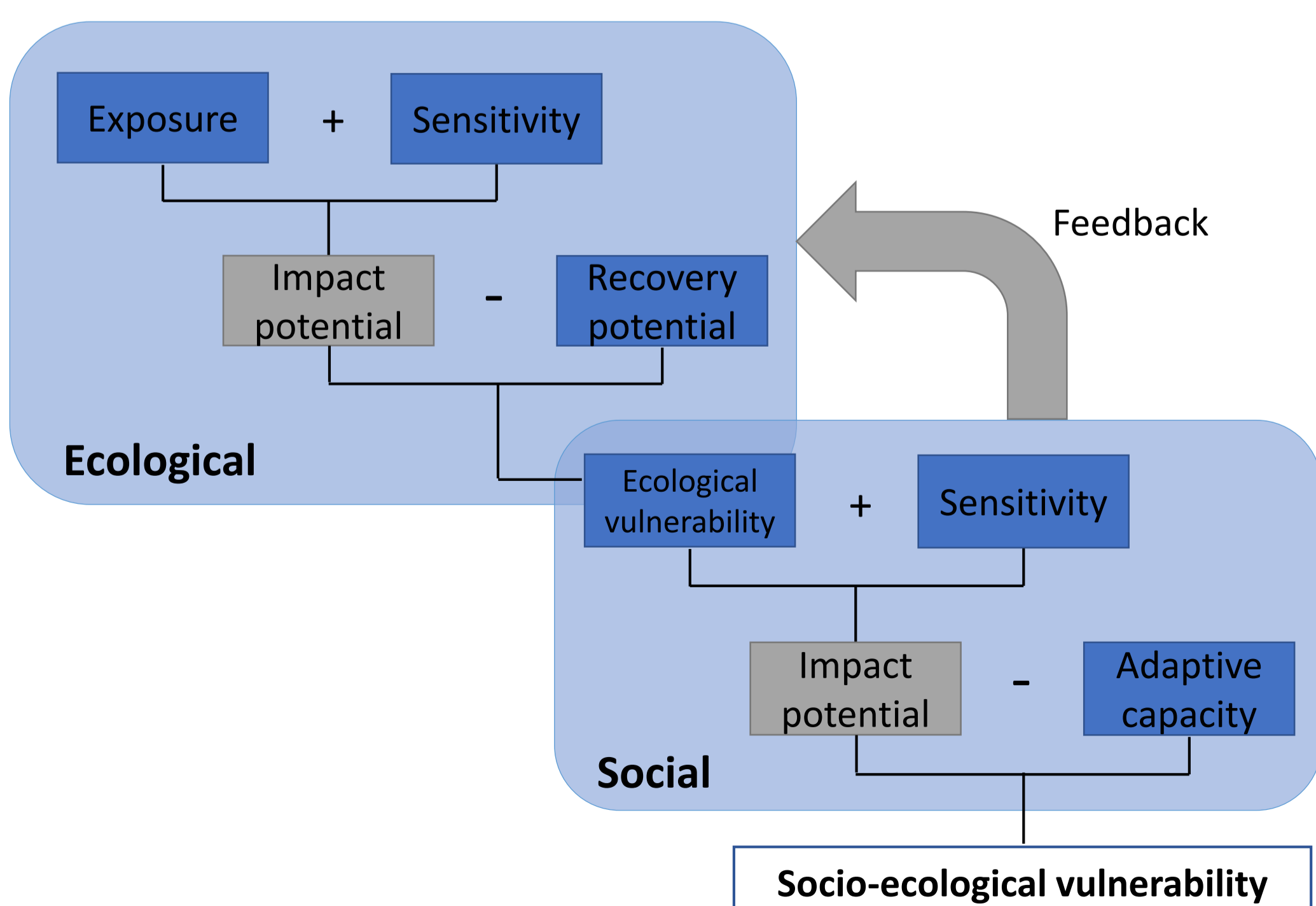- Qualitative scale: Semaphore

Figure 1. Heuristic framework for the determination of socio-ecological vulnerability (Modified from Marshall *et al.,* 2010).
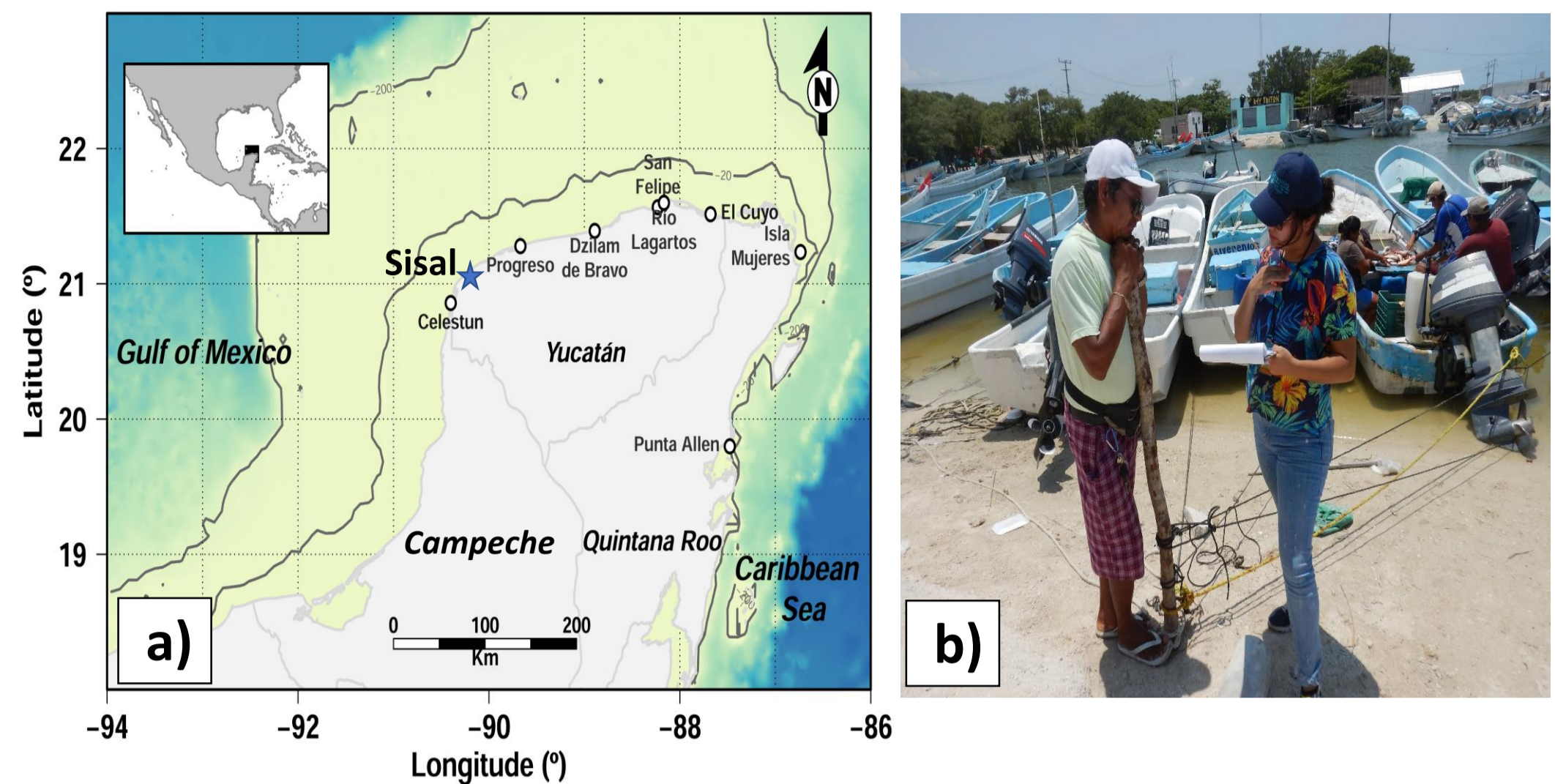

Figure 2. a) Geographic location of the Yucatan Peninsula; b) Interviews to fishers in Sisal, Yucatan.

Preliminary Results

Ecological
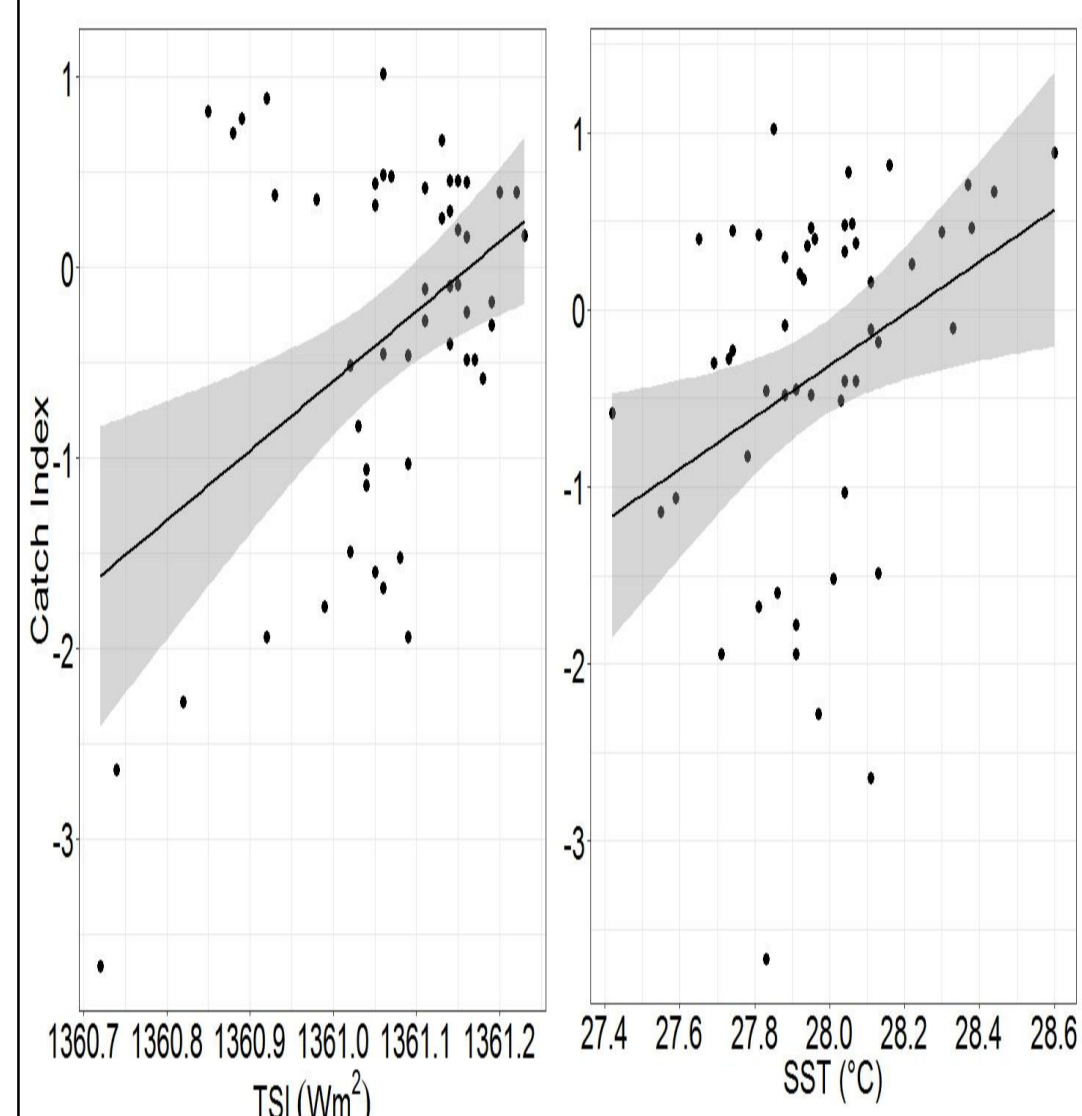#### Sensitivity

Figure 3. GLM Gaussian Catch Index ~ TSI + SST
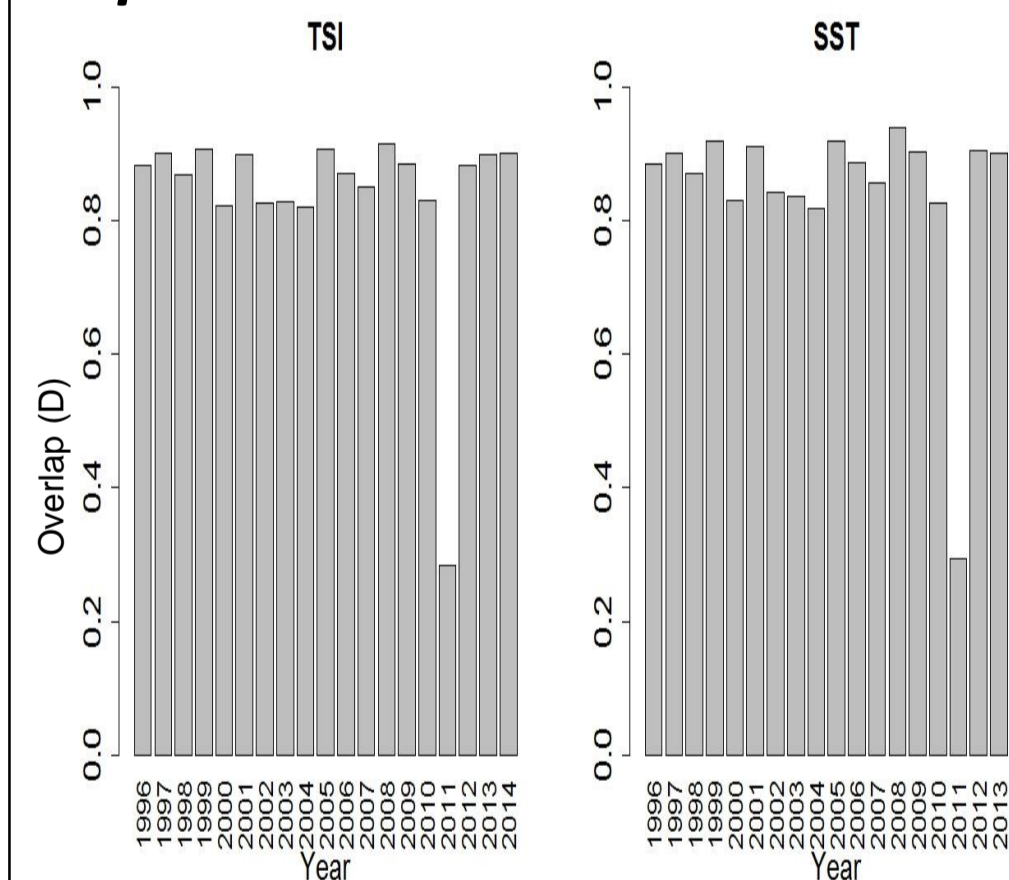
Deviance=36.69   AIC=132.12

Exposure

Figure 4. Tendency overlap (D) Catches ~ TSI + SST

High Overlap (D) Catches ~ TSI + SST

$\overline{D}_{TSI} = 0.84$ $\overline{D}_{SST} = 0.85$

Social

Table 1. Interviews to fishers from Sisal, Yucatan

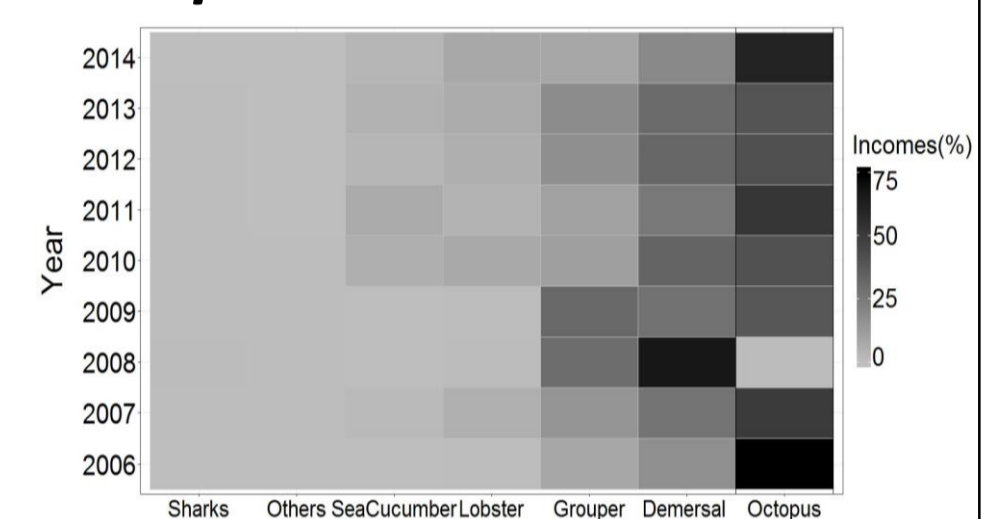| Fishers	n
Independent	37
Cooperative	54
Firm owners	9

Total=100

Exposure

Figure 5. Percentage of income by species landed in Sisal, Yucatan
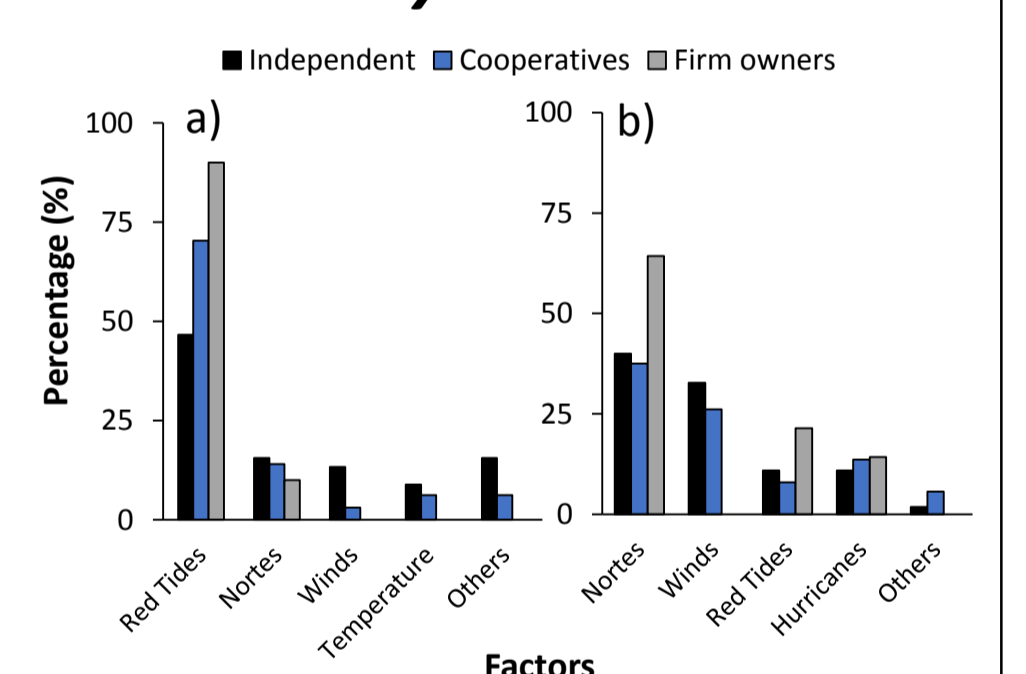
Sensitivity

Figure 6. a) Factors that affect resource b) Factors that affect operations
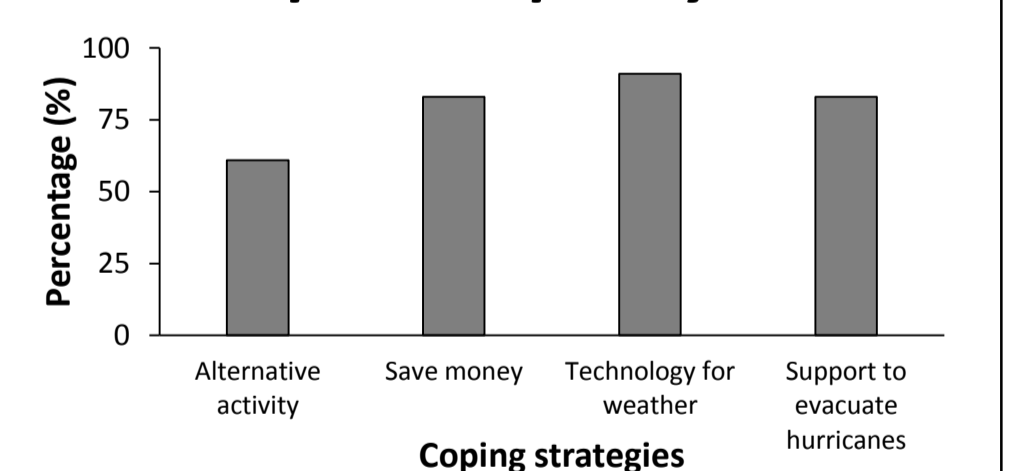
Adaptive capacity

Figure 7. Coping strategies of the fishers from Sisal, Yucatan

Conclusions

Ecological
- Octopus population is sensitive to TSI and SST.
- High exposure to TSI and SST has been evident in the last 19 years.

Social
- Fishers have high dependence on the resource.
- The "nortes" and the red tides affected the most the fishers.
- Fishers have developed coping strategies to face social, economic and climatic drivers of change.

References:
Adger, W. N. 2006. Vulnerability. Global environmental change, *16*(3), 268-281.
Marshall, N. A., Marshall, P. A., Tamelander, J., Obura, D. O., Mallaret-King, D. and Cinner, J. E. 2010. A framework for social adaptation to climate change: sustaining tropical coastal communities and industries. Gland, Switzerland, IUCN, 36.
Schoener, T. W. 1968. The Anolis lizards of Bimini: resource partitioning in a complex fauna. Ecology, 49(4), 704-726.