

# Assessing the ENSO impact on the annual shrimp catch in the Sofala Bank, Mozambique Shelf

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## 1. Introduction and Objectives

- ❖ Sofala Bank (16-21°S;34-41°E) in the Mozambican Shelf (Figure 1) hosts an important commercial shrimp fishery (De Sousa et al., 2011) managed by the Mozambican Ministry of Fisheries.
- ❖ The two major shrimp species are *Penaeus indicus* and *Metapenaeus monoceros*.
- ❖ Interannual fluctuations in shrimp catches (Figure 2) could, in part, be driven by oceanographic and climate factors.
- ❖ The El Niño Southern Oscillation (ENSO) is one major driver of interannual climate variability (Trenberth, 1997).
- ❖ **Objective:** to assess the impact of ENSO on the annual shrimp catches over the period 1980-2016.

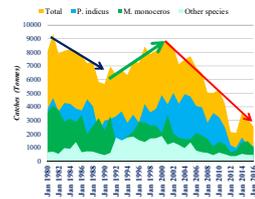


Figure 2. Annual shrimp catches are decreasing

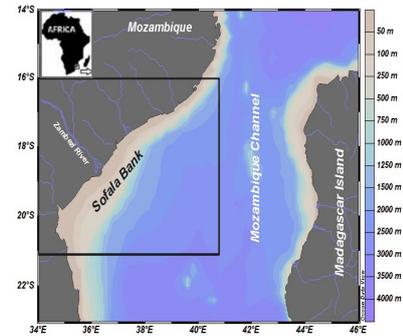


Figure 1. Sofala Bank Maximum depths: 200 m)

## 2. Data and Methods

### 2.1. Data

- ❖ Annual shrimp catch for *P. monodom*, *M. monoceros* and other species and for the total catch. Data from the IIP-Fisheries Research Institute-Mozambique.
- ❖ ONI- representing ENSO. It is based in SST anomalies in the El Niño 3.4 region (5° N-5° S, 120- 170° W), (Smith et al., 2008).
- ❖ El Niño: ONI>0.5°C
- ❖ La Niña: ONI<-0.5°C
- ❖ ONI data (<https://ggweather.com/enso/oni.htm>)
- ❖ Study period: 1980-2016

### 2.2. Methods

- ❖ Linear and non-linear regressions on the time series of annual catches and ONI.
- ❖ Tools: Matlab R2013a and MS. Excel.

## 3. Results

### 3.1. Time series of ONI and shrimp catch

No coherence found between the maximum/minimum catches and El Niño (EL) and La Niña (LN) events (Figure 3(a-c)).

Major peaks occurred during ENSO neutral conditions.

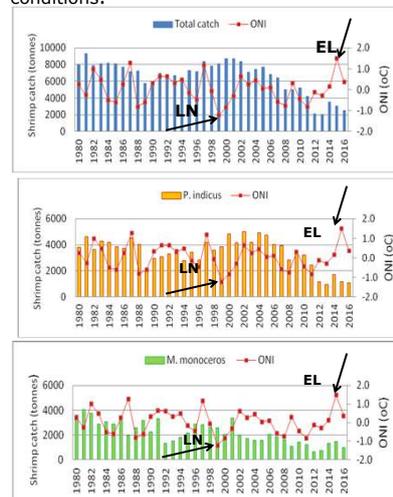


Figure 3. Time series of annual (a) total, (b) *P. indicus*, (c) *M. monoceros* and (d) other species and ONI

### 3.2. Correlations: ONI and total shrimp catches annual time series

Not linearly associated if using the interval 1980-2016. However, non-linear regressions (Figure 4(a-c)) show ONI and catch association of:

- ❖ 20% (1980-2016)
- ❖ 23% (1980-1989)
- ❖ 64% (1990-1999)
- ❖ 51% (2000-2016)

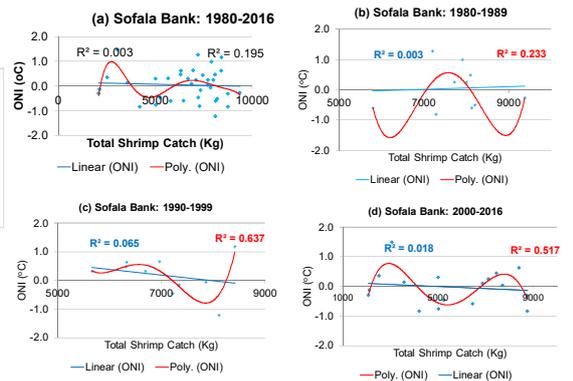


Figure 4. Scatter plots: ONI and total shrimp catches. Regression fits: blue for linear and red for non-linear

## 5. Summary and Way Forward

- ❖ The major/minor peaks of shrimp catches (1980-2016) were independent of La Niña and El Niño events. They occurred during ENSO neutral conditions.
- ❖ No significant linear correlations were found. However non-linear regression suggest an association of ~20-60% between ENSO events and shrimp catches.
- ❖ Further analysis are required, including data sets of Chlorophyll-a concentration, sea surface temperature and sea surface height anomalies.

## 6. References

- De Palha Sousa, L., Brito, A., Abdula, S., Maunde, C., Penn, J. W., & Howell, D. (2011). Assessment of the shallow water shrimp fishery of Sofala Bank Mozambique (2010 season) and management options for 2012 season.
- Smith, T. M., Reynolds, R. W., Peterson, T. C., & Lawrimore, J. (2008). Improvements to NOAA's historical merged land-ocean surface temperature analysis (1880-2006). *Journal of Climate*, 21(10), 2283-2296.
- Trenberth, K.E., 1997. The definition of El Niño. *Bulletin of the American Meteorological Society* 78, 2771-2777.

## Acknowledgements

