El Niño revisited: the influence of El Niño Southern Oscillation on the world’s largest tuna fisheries

BACKGROUND

In the Pacific Ocean (PO), El Niño Southern Oscillation (ENSO) influences the dynamics of the world’s largest tuna fisheries and ecosystem structure. During La Niña (cold phase), the warm pool is restricted to the far western equatorial Pacific whereas during El Niño (warm phase) it stretches to the eastern Pacific following the weakening of equatorial upwelling system (cold tongue).

MATERIAL & METHOD

3 simulations | 2 species | 2 age classes
Detrending | Position proxies | Wavelet analysis | Temporal lags | Correlation

ONI is the running 3-month mean SST anomaly for the Niño 3.4 region (i.e. 5°N, 5°S, 120°W, 170°W). ONI is positive during El Niño and negative for La Niña. Values of ONI above 0.9 are classified as El Niño and those below -0.9 as La Niña. Values between 0.9 and 0.9 are classified as Neutral.

Both skipjack abundance and distribution are impacted by ENSO. Biomass increases in area 6 approximately 16 months after El Niño onset. The same phenomenon occurs for skipjack juvenile with a shorter lag (~5 months).

Each tuna dynamics simulation is achieved using robust statistical parameter optimization fitting several hundred thousands data (catch and size of fish). However, these different solutions express similar impacts of ENSO on biomass distribution and abundance, with species and age characteristics.

DISCUSSION

One year and half after an El Niño onset, the maximum impact is observed in skipjack biomass. This lag was due to better recruitment during El Niño (wider favorable spawning habitat). This association is not as emergent in other stock-assessment models (Fig. 11). Further independent datasets are needed to confirm these results, however they suggest that ENSO may be an important process explaining the resilience of skipjack to high exploitation rates.