

# Synchronicity of anchovy catches in the Humboldt Current Ecosystem



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## Abstract

Interdecadal versus interannual time-scale variations of catch data of three anchovy stocks distributed in the Humboldt Current System (HCS) were analyzed. First a loess smoother was applied (Fig. 1), then the residual data were considered as the interannual, high-frequency variation. Long-term changes were highly coherent for the three stocks of anchovy distributed in the HCS (Fig. 2), while only the north-central Peru stock was similar to the south Peru-northern Chile stock in terms of high-frequency variation (Fig. 3). The interannual component of fluctuation of these stocks was significantly and negatively related with El Niño-Southern Oscillations events occurring during the spring of the previous year (Fig. 4).

## DATA AND METHOD

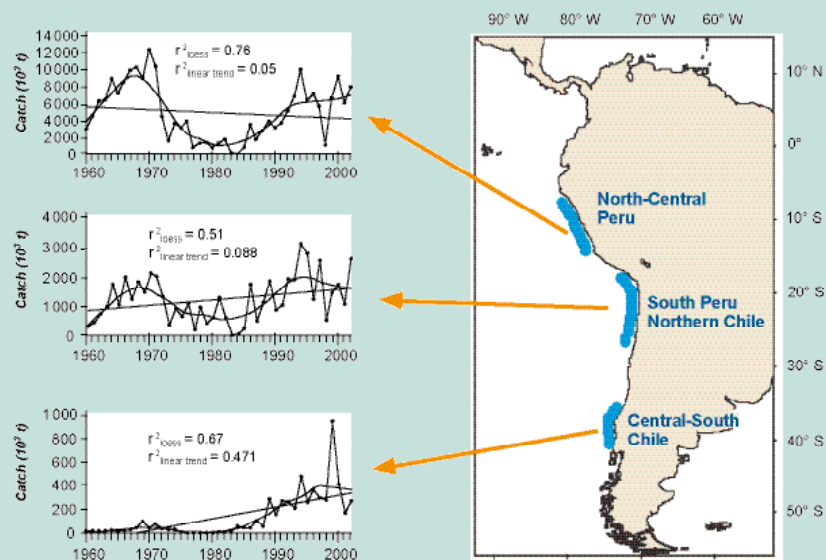


Fig. 1 – Left: Raw annual data of catches and two fitted functions (loess smoothing and linear trend) for the three anchovy fishing areas. Right: the three anchovy fishing areas.

## REFERENCES

Cubillos, L.A., Serra, R. and Fréon, P. Synchronous pattern of fluctuation in three anchovy stocks in the Humboldt Current System. Submitted to *Aquatic Living Resources*.

## INTERDECADAL SCALE: 3 HIGH SYNCHRONIES

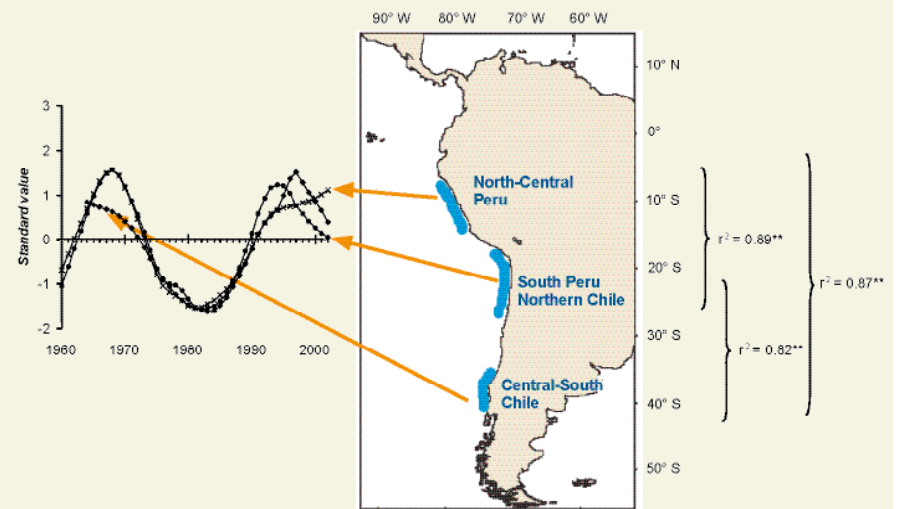


Fig. 2 – Left: standardized anomalies of loess smoothed values of catches for the three anchovy fishing areas. Centre: the three anchovy fishing areas. Right: Spearman correlation coefficients between couple of time series (\*\* =  $P < 0.01$ ).

## INTERANNUAL SCALE: ONLY ONE SYNCHRONY

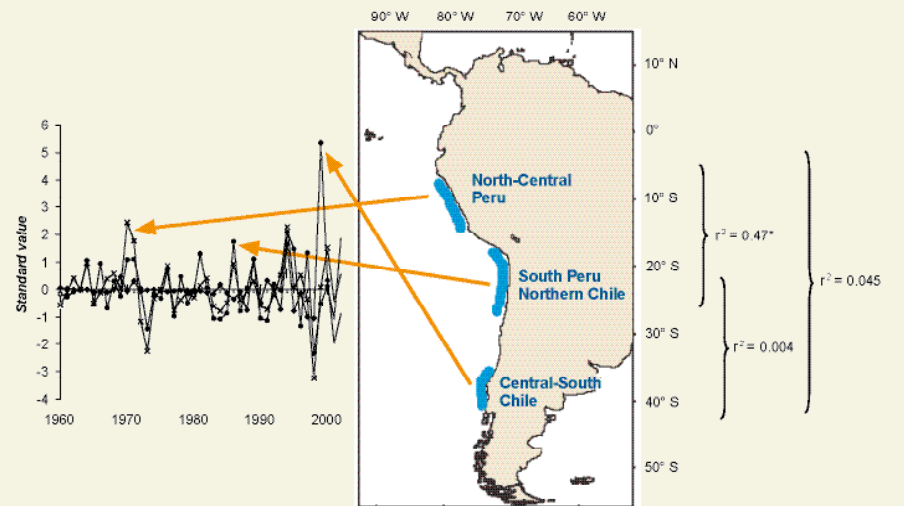


Fig. 3 – Left: standardized anomalies of the residuals of the loess smoothed values of catches for the three anchovy fishing areas. Centre: the three anchovy fishing areas. Right: Spearman correlation coefficients between couple of time series (\* =  $P < 0.05$ ).

## INTERANNUAL SCALE: 2 SIGNIFICANT RELATIONSHIPS BETWEEN CATCHES AND TEMPERATURE

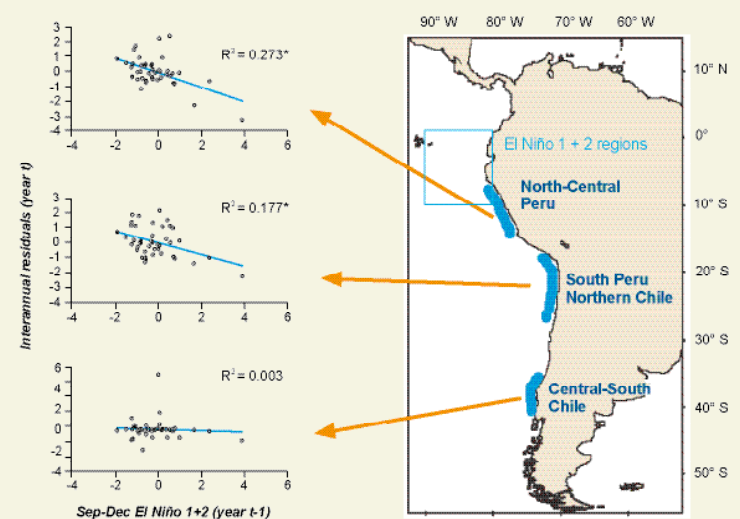


Fig. 4 – Left: Regressions between the interannual residuals (standardized values) and sea surface temperature anomalies in the El Niño 1+2 regions (0-10°S, 90-80°W) during the austral spring for the three anchovy fishing areas (\* =  $P < 0.05$ ). Right: the three anchovy fishing areas.

## Conclusion

Long-term, low-frequency synchronous variations in the three anchovy stocks suggest a common forcing by long-term environmental factors in the HCS, although other causes cannot be excluded. During the last 40 years, this synchronous pattern is out of phase with large-amplitude sardine regimes. Decadal and interdecadal climate variability seems to be the main cause for long-term fluctuations in anchovy stocks in the HCS, although available time series are too short to prove this link and exclude the hypothesis of non-environmental forcing.

