

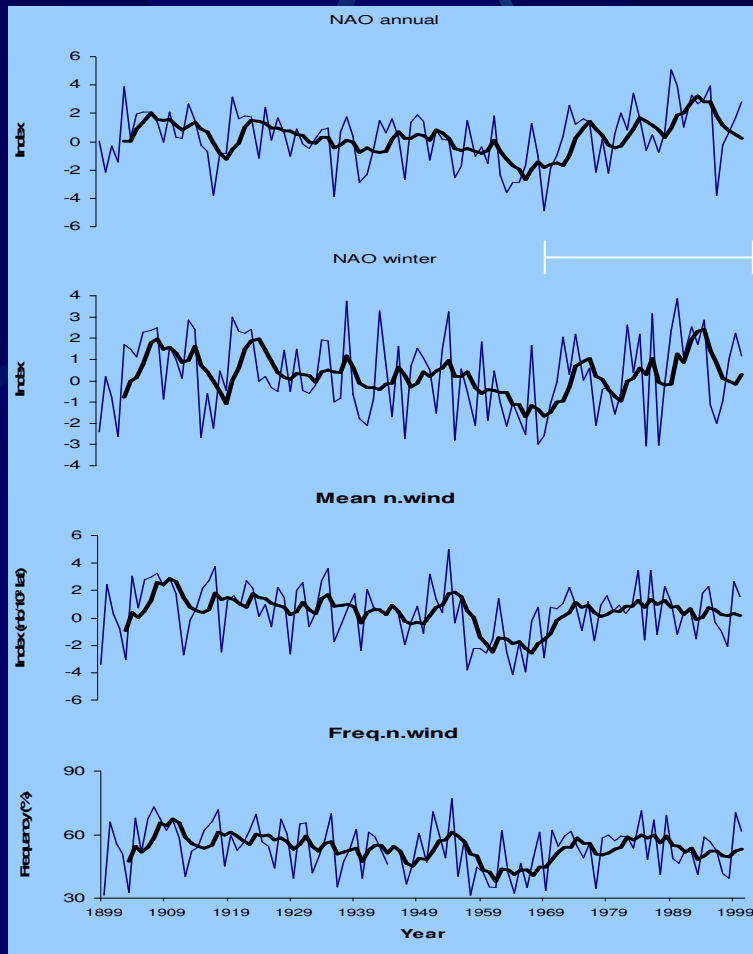
**Casablanca, Maroc,
11-14 Mars 2008**

*Sardine (*Sardina pilchardus*)*
Recruitment is strongly affected by
climate even at high spawning biomass

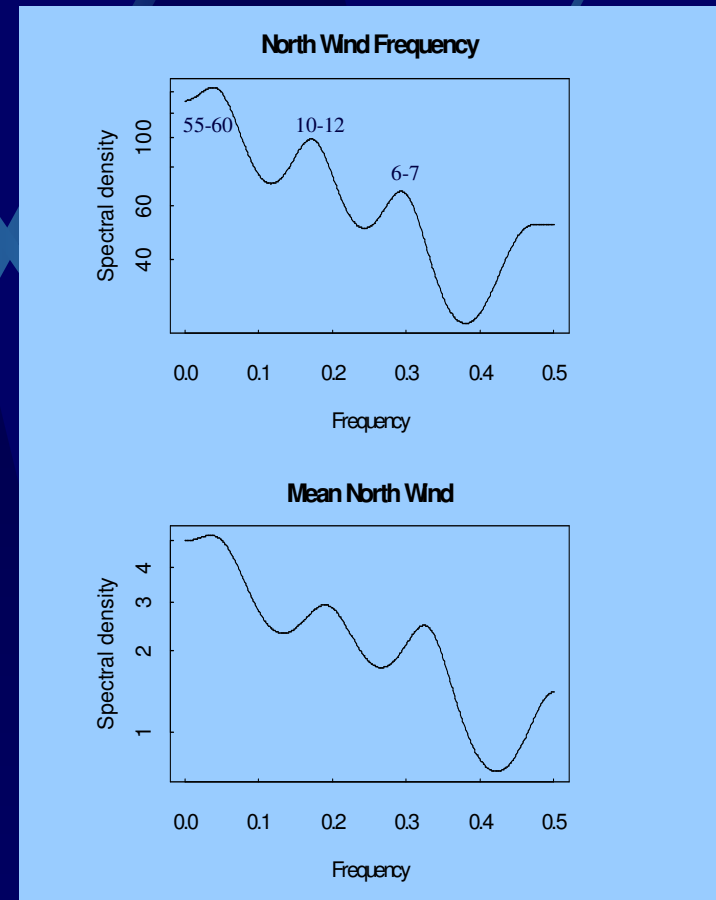
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NAO and North wind (1899-2000)



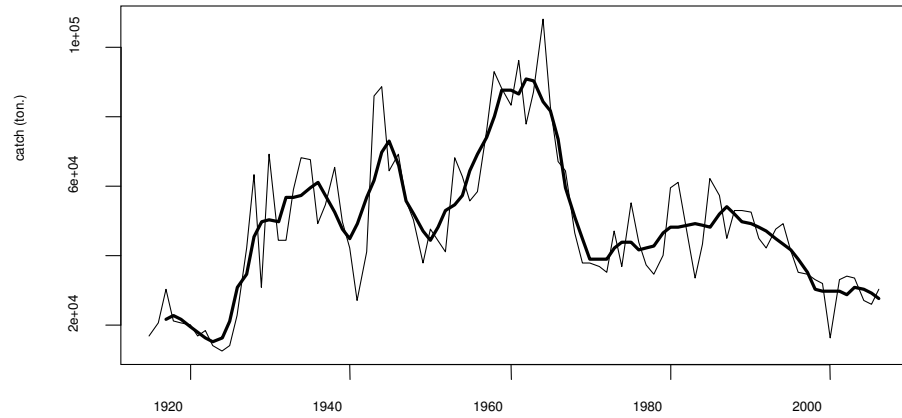
High NAO index
since the 70s



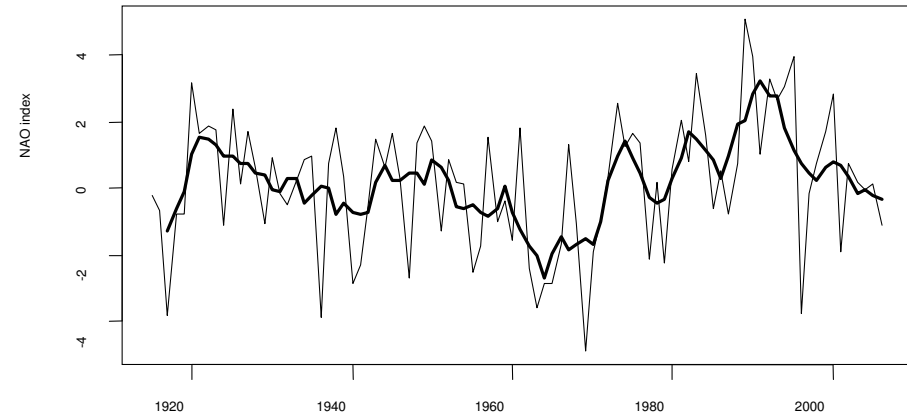
- Short term periods of 6-7 years
- Medium term periods of 10-12 years
- Long term periods of 55-60 years

Sardine, catches, winter NAO index, upwelling index and north wind winter- West

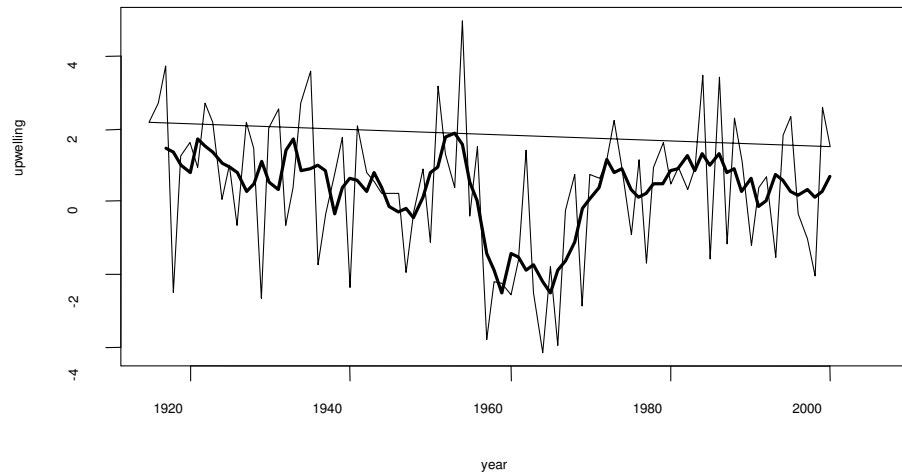
NW sardine catches



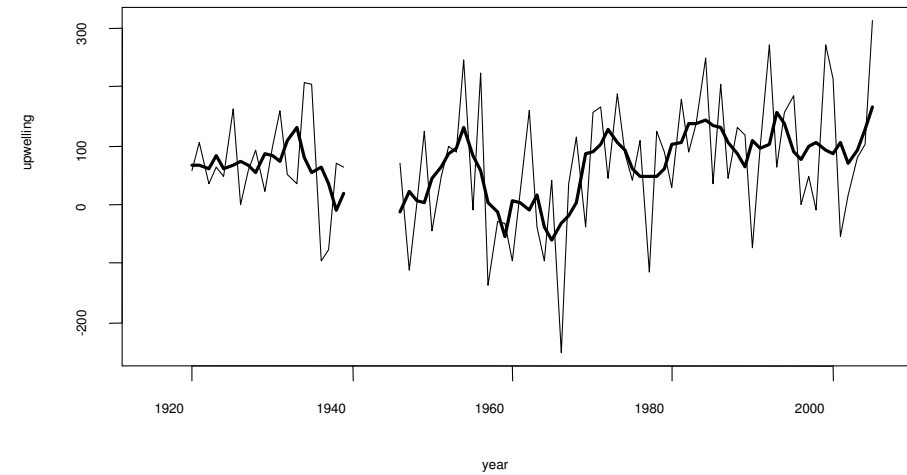
NAO



north wind winter



upwelling winter



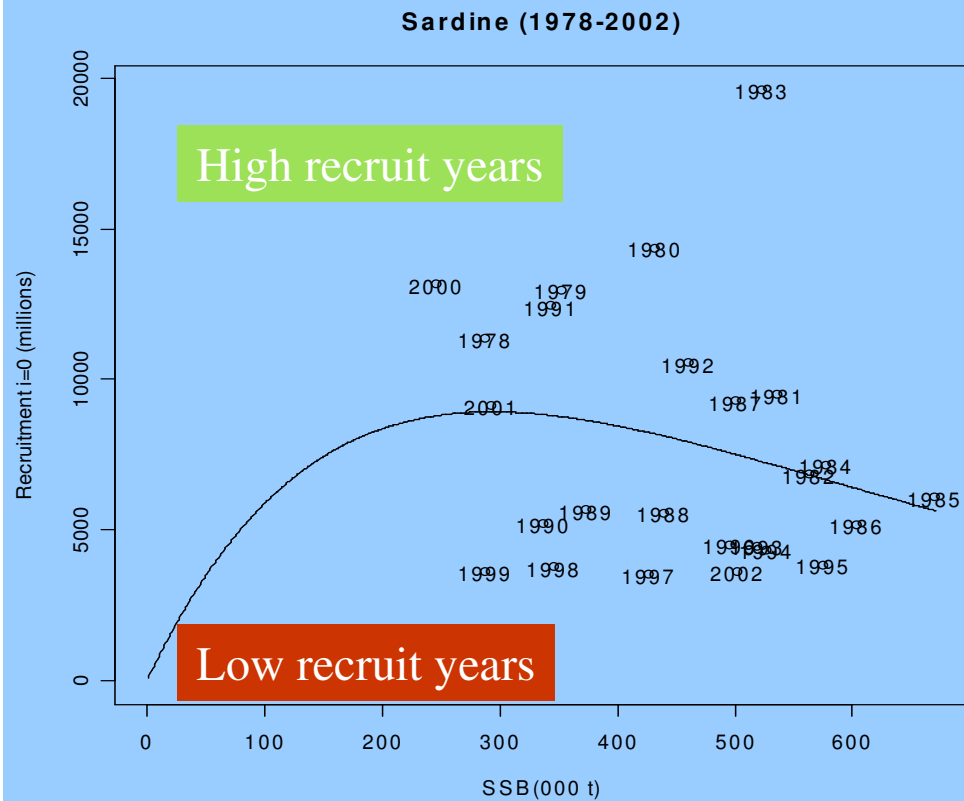
Correlation matrix of the estimated linear association between sardine catches, the winter upwelling conditions and NAO index.

***** Significant at the 0.1% level, ** Significant at the 1% level, * Significant at the 5% level (p-value)**

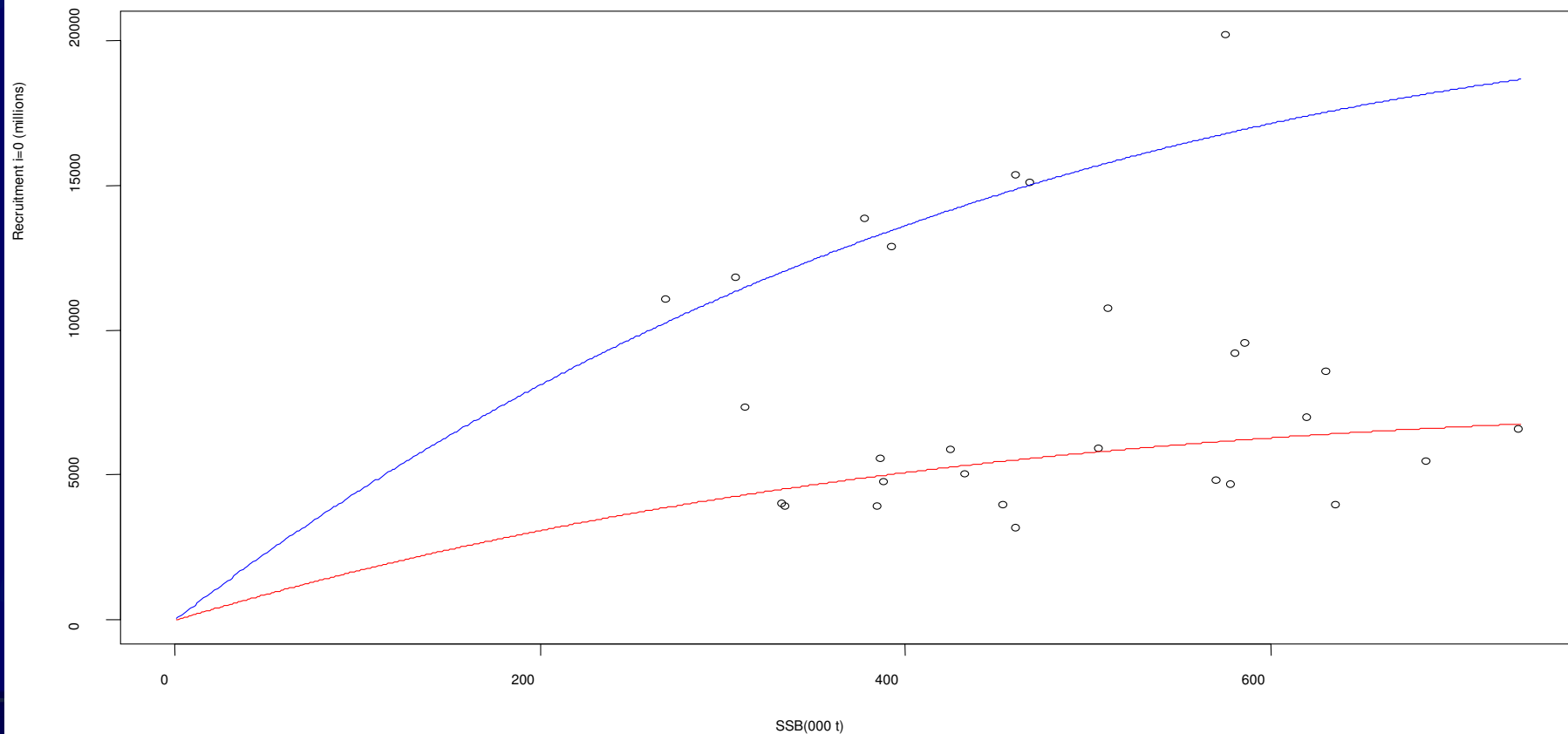
	NW catches	NAO Index	Winter north wind	Winter Upwelling
NW catches	1.00			
NAO Index	-0.11 ^[0.309]	1.00		
Winter north wind	-0.34 ^{** [0.001]}	0.33 ^{** [0.002]}	1.00	
Winter Upwelling	-0.27 ^{* [0.013]}	0.41 ^{*** [0.000]}	0.80 ^{*** [0.000]}	1.00

Sardine Ricker stock-recruitment model

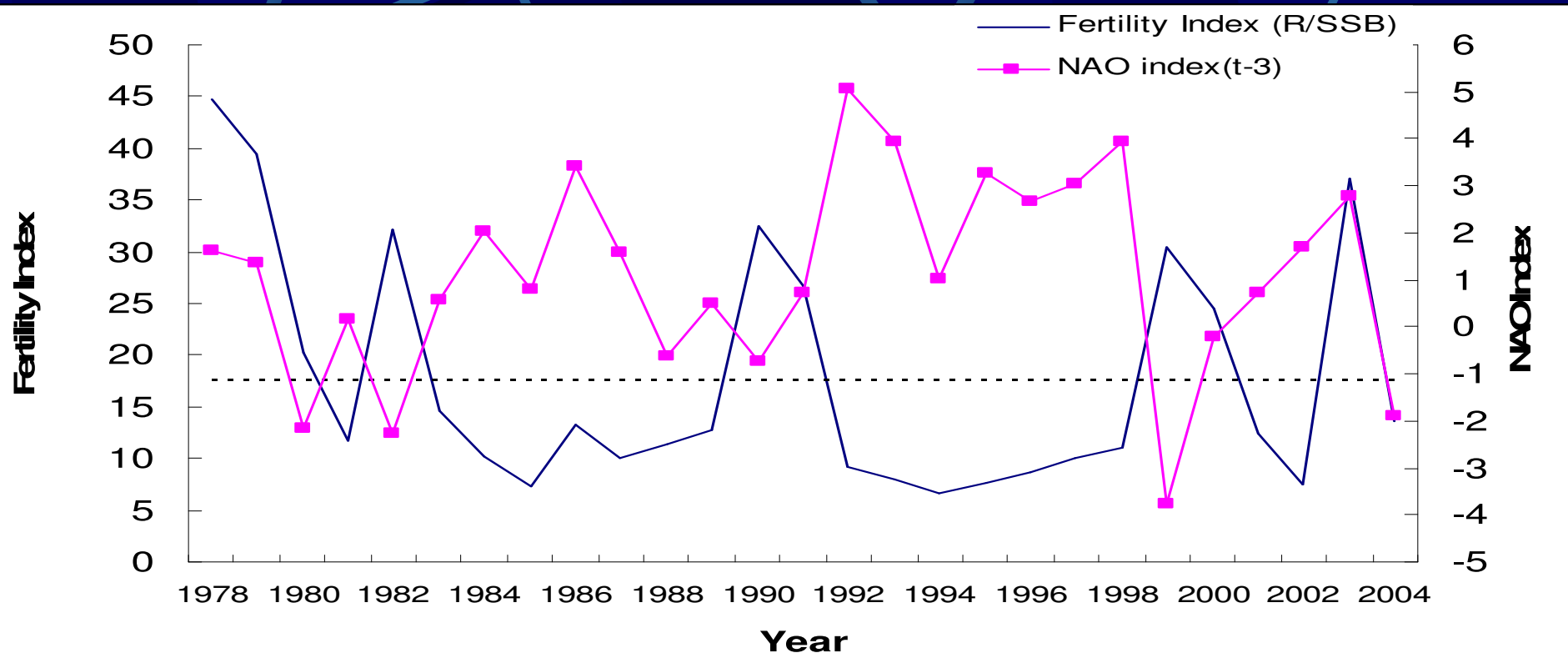
$$R_t = \alpha SSB_{t-i} e^{(-\beta SSB_{t-i})}$$



Ricker models fitted to high productivity years (blue) and low productivity years (red).



SARDINE



* Significant correlation (p -value <0.1 , 90%level)

Operational indicator between productivity regimes

- NAO + (positive) ▶ Winter Northerly winds present over northern shelf – Constrains plankton productivity and small pelagics recruitment low over northern shelf (spatial topography)
- NAO - (negative) ▶ No winter north winds present over northern shelf ▶ higher probability of stronger productivity in the system

Investigate operational scenarios for fisheries management advice

- Simulate to set reference points by regime
- Use Harvest Control Rules to switch from Low to High productivity regimes
- Close monitoring to manage the stock in the gradient (transitional periods)
- Investigate spatially disaggregated management scenarios

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