Portuguese Marine Fisheries in the context of **Ecosystem Services:** Driving factors between 1989 - 2014

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FUNDAÇÃO CALOUSTE **GULBENKIAN**

Background

Ecosystem Services

Marine fisheries constitute an important food supply

Provisioning Ecosystem Service

Portugal is the 3rd country in fish consumption per capita

 65 kg y^{-1} (FAO) - 40% of it is "bacalhau" (cod)



Implementation of Common Fisheries Policy of the European Union: Decrease Effort!!

FAO National INE -- FAO 450000 400000 350000 300000 Landings (MT) 250000 200000 150000 100000 50000 0 938 944 941 Year

Leitão et al. 2014

Background

The decrease in landings since the 1960's is a fact:

- → Was it a consequence of a reduction of fish stocks? ~ Deterioration of the Ecosystem Service?
- → Was it a consequence of the reduction of fishing effort?
- → Are there other variables driving fish landings?

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- → Are there other variables driving fish landings? WHICH VARIABLES?

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- → Are there other variables driving fish landings? WHICH VARIABLES?
- → What about different gears and regions?

- Trawling
- Purse-seine
- Multi-gear

Fish landings compilation in mainland Portugal between 1989 and 2014



TRAWLING

- Trawling
- Purse-seine
- Multi-gear

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PURSE-SEINE

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MULTI-GEAR



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Fishing effort: days at sea









The decrease in fishing effort has been faster than the decrease of fish landings Substitution of species and technological improvements

Fish landings (quantity and species composition) can not be solely understood as a function of fishing effort Other variables could be directly or indirectly involved

→ SOCIAL VARIABLES

Fuel priceGDPGDP growth rateUnemployment rate



→ ENVIRONMENTAL VARIABLES

SSTUpwellingSST anomalyRiver dischargePrecipitationNAOEAAMOEffort

Dynamic Factor Analysis (DFA) is a dimension reduction technique that can be used to model several short (15-25 years) time series in terms of common trends and explanatory variables (Zuur et al. 2003; Zuur and Pierce, 2004).

Cycles, trends, and residual variation in the Iberian sardine (Sardina pilchardus) recruitment series and their relationship with the environment

M. Begoña Santos^{1*}, Rafael González-Quirós², Isabel Riveiro¹, José M. Cabanas¹, Carmela Porteiro¹, and Graham J. Pierce^{1,3}

Dynamic factor analysis to estimate common trends in fisheries time series

A.F. Zuur, I.D. Tuck, and N. Bailey

FISHERIES OCEANOGRAPHY

Fish. Oceanogr. 14:3, 195-209, 2005

Trends in NE Atlantic landings (southern Portugal): identifying the relative importance of fisheries and environmental variables

INTRODUCTION

GEAR	REGION	MODEL
Trawling	North-west	3 trends + river autumn + effort
	Centre-west	2 trends + SST winter
	South-west	3 trends + river autumn + effort
	South	3 trends + SST winter
Purse-seine	North-west	3 trends + river autumn + GDP
	Centre-west	2 trends + effort + GDP
	South-west	2 trends + effort + GDP
	South	3 trends + river autumn + precipitation
Multi-gear	North-west	2 trends + SST winter
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	South-west	3 trends + river autumn + effort
	South	2 trends + river autumn + precipitation

TRAWLING



SOUTH

SOUTH-WEST





PURSE-SEINE



SOUTH

SOUTH-WEST

CENTRE



MULTI-GEAR



SOUTH

SOUTH-WEST





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Social variables seem to be more important for the fishery of purse-seine This is a small-scale family-based fishery

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River discharge during autumn, SST during winter and annual precipitation in the South were consistently selected as variables **River discharge enhance primary production** in autumn which is important for the feeding of juveniles of sardine and other pelagics Winter SST could be also important for the survival of recruits

Take home messages

The benefit obtained by the Ecosystem Service provided by marine fisheries in Portugal has decreased since the 1960's. This is a consequence of decreasing effort, albeit other social and environmental variables seem to be involved. Fishing effort and GDP are the main social factors driving changes in bulk landings, specially for purse-seine. On the other hand, river discharge in autumn, SST in winter, and annual precipitation (the later only the South) are relevant to explain fish landings, probably because of ecological implications on recruitment. Management of marine fisheries can not rely solely on controlling fishing effort. Contact: jbuenopardo@gmail.com

Thanks for your attention

Obrigado / Grazas!!





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