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The trawl fishery of Alicante Gulf: Standardization of Catch per Unit of Effort and Estimation of Abundance Indices

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Introduction

The Catch per Unit of Effort (CPUE) of the fishing fleet has been proposed as an indicator of relative abundance of the target stock, under the assumption that both are directly proportional, with the catchability coefficient (q) constant. However, in practice this proportionality almost never met, because the catchability coefficient always change with time, due to the influence of factors related to fish behaviour and the behaviour of the fishing fleet. Thereby, the use of commercial fisheries statistics in constructing abundance indices requires standardization, In multispecies fisheries, the method to achieve standardization was th application of Generalized Linear Models (GLM)

Aim of this study

The aim of this study was to identify the main factors affecting catch rates (CPUE) and to obtain abundance indices of the four main trawl fishery target species (European hake: Merluccius merluccius, the Red shrimp: Aristeus antennatus, Norway lobster: Nephrops norvegicus and the Red mullet: Mullus spp.) in Alicante Gulf (western Mediterranean Sea) over a 11-year period (2002-2012)

Methods

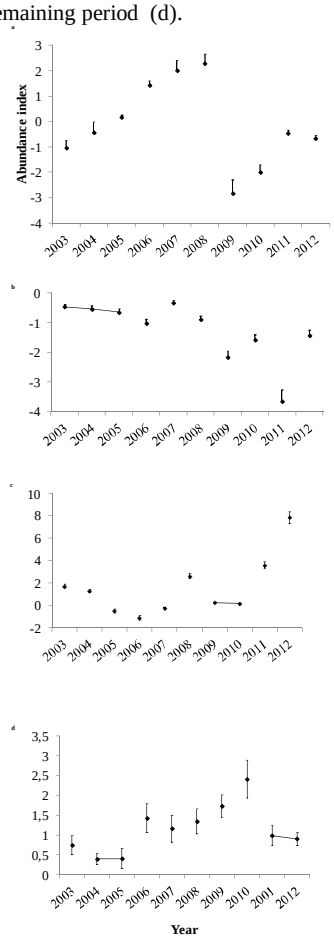
Four principal métier, for European hake: *Merluccius merluccius*, the Red shrimp: *Aristeus antennatus* Norway lobster: *Nephrops norvegicus* and the Red mullet *Mullus spp*), were identified, Multivariate techniques cluster, nMDS and SIMPER, were used to determine catch profiles and to link it back to the vessels by assigning each of the samples (vessel/day) with their characteristics to one of the métiers.
The GLM were applied to the daily CPUE (kg · vessel^{-1}· day^{-1}) of each target species. Since the number of samples had more than 10% of zero, Delta method was applied (Punt et al. 2000). The Delta method uses a combination of two GLM, one is a Log-normal model (positive CPUE) and the other is a Binomial distribution (proportion of positive CPUE). For positive CPUE, Log-normal that is the most common in CPUE data (Maunder and Punt 2004; Porter et al. 2003).

Catch rates ($\mu_{ijklmnp}$) of each species was modeled as a function of $Year_i$,$Month_j$,GT_k, GRT_l, TL_m,HP_n and $métier_p$. Double interactions among all factors were also included with the aim of determining which factors best explained the observed variability in catch rates.Vessel characteristics (*GT*, *GRT*, *Tl* and *HP*) were categorized into 4 classes ,
The initial general model used was:

$$\log(\mu_{ijklmnp}) = \alpha + Year_i + Month_j + GT_k + GRT_l + TL_m + HP_n + métier_p + \varepsilon_{ijklmnp}$$

Results

For the four target species, the *métier* factor is having a major effect on Gaussian and binomial model. The model was chosen explains 66%, 37 %, 47% and 47% for *Merluccius merluccius*, *Aristeus antennatus*, *Nephrops norvegicus* , and *Mullus spp*
The abundance index, taking 2002 as the reference year. For *Merluccius merluccius*, (a) the trends were increasing between 2003 and 2008 low in 2009 and again increase from 2009 to 2012. With regard to *Aristeus antennatus (b)*, abundance index shows an overall declining trend except in 2007, 2010 and 2012 where there were some peaks.
For *Nephrops norvegicus*, abundance index, showing a downward trend between 2003and 2006and almost growing trend in the rest of the period except drop in 2009 and 2010 (c). For the *Mullus spp*, Abundance index showing a downward trend in2003-2005and crescent from 2005 to 2010 and back down in the remaining period (d).



Discussion

The GLM used in this study including factors Year, Month, GT, GRT, TL , HP and métier could be considered useful to reduce the variability of CPUE data of the 4 species under study
the increase of annual abundance indices for *Merluccius merluccius* can be explained by biologic aspects such as recruitment, and management measures applied in the Alicante Gulf.
For *Aristeus antennatus* (Maynou 2008) suggested that the North Atlantic Oscillation (NAO) is positively correlated with annual landings of shrimp, while (Mamouridis et al. 2014) noted that the NAO had a negative annual average between 2002 and 2008. The annual declines in abundance of *Nephrops norvegicus* between 2003 and 2006 were influenced by the technical characteristics of vessels and fishing effort because higher values of average GT, GRT and HP were recorded between 2002 and 2006.
The increase in abundance indices between 2005 and 2010 for *Mullus sp* can be explained by the low fishing effort on this species during this period

References

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