

Preliminary results on the abundance of alien species in the coastal fisheries catches of Crete

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Abstract

The biomass and abundance proportion of alien species on the catches of coastal fisheries in Crete were analyzed, based on data from on-board observations. The probability of catching alien species was estimated by gear type and fishing area by means of Generalized Linear Modeling (GLM) techniques. Results indicated that there is higher probability of catching alien species on nets than on longlines, and depending on the area and gear, this can be up to 60%. Findings suggest that alien species have been successfully established in the marine ecosystem of Crete.

Keywords: alien species, abundance, coastal fisheries, Crete

1. Introduction

In the eastern Mediterranean a large number of marine alien species have been introduced and have established populations (Golani et al., 2002; Zenetos et al., 2012). The majority of them are of Indo-pacific origin, due to the construction of the Suez Canal in 1869. The expansion of alien species in the Greek Seas has been studied by many scientists in the past, but most of the studies refer to the introduction, or the occurrence of various alien species in the area (Zenetos et al., 2011). Very few past studies give some quantitative information on the abundance of alien species in the Greek Seas (Lefkaditou et al., 2010; 2013; Kalogirou et al., 2012; Peristeraki et al., 2013; Tsiamis et al., 2013; Dimitriadis et al., 2013). In the present study, data on abundance and biomass of alien species, caught on coastal fisheries of Crete, are analyzed and the pattern of the abundance ratio (in number and weight) of invasive/native species is examined.

2. Materials and methods

Random sampling of 85 fishing operations (sets) of coastal fishing boats was realized in Crete, by observers on board. The sampling took place from October 2013 to October 2014, in the frames of the National Fisheries Data Collection Framework following a monthly sampling scheme. For each fishing operation, the catches of native and invasive species have been recorded and the biomass and abundance proportions (%) of invasive species in the total catch have been calculated. Sampling covered the fishing gears used by small scale fishery in the coastal zone categorized in 2 types: nets (N) and bottom long-lines (LL). In addition, data were classified by major sampling area, i.e. north (NC) and south Crete (SC).

Given the relatively large number of sets with zero catches of invasive species (>50%), subsequent analysis was based on a presence-absence matrix for those species that was built from the observed fishing operations. The obtained Bernoulli-type 0/1 measurements (0 for absence, 1 for presence) were analyzed by means of Generalized Linear Modeling (GLM) techniques (McCullagh & Nelder, 1983), assuming a binomial error structure model and a logit link function. The predictors considered were the area of capture and the gear type. Model fitting was accomplished under the R language environment (R Development Core Team, 2013) and statistical inference was based on the 95% confidence level.

3. Results

The frequency of the estimated abundance (Nprop) and weight (Wprop) proportions of alien species in the catches indicated that their relative amount is generally higher in nets than in longlines (Fig. 1, 2). The Nprop in North Crete, ranges from 0- 7.5% for the nets and 0-2.5% for the longlines, while in South Crete the maximum longline Nprop value reached up to 17.5%. Similarly, the Wprop values are higher, in general, in net catches. In N. Crete, the Wprop ranges from 0-60% and 0-2.5% for nets and longlines respectively. In S. Crete the Wprop values range from 0-60% for both gears.

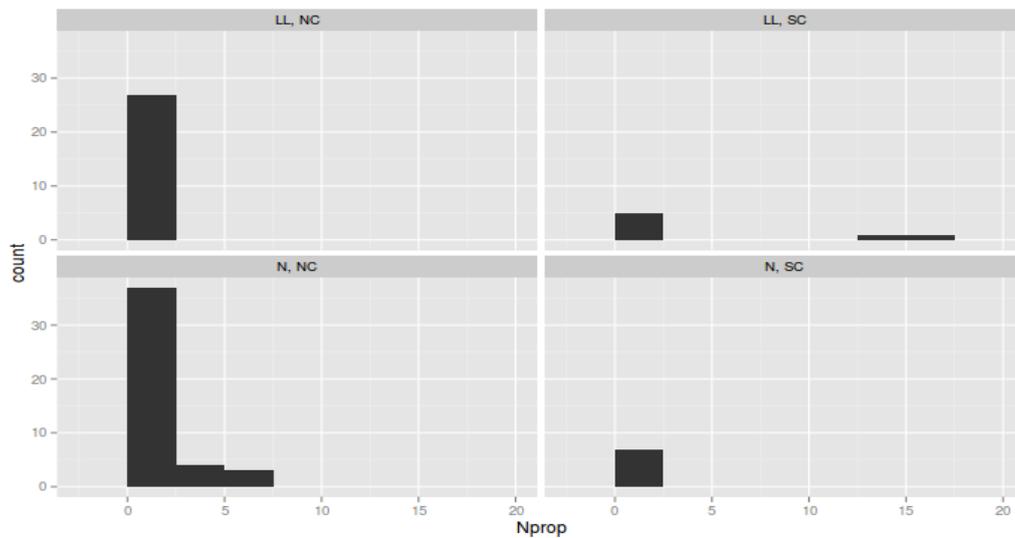


Fig. 1. Frequency of the observed abundance proportions (%) of alien species in the catches, by gear and area. N=nets, LL=longlines, NC=North Crete, SC=South Crete.

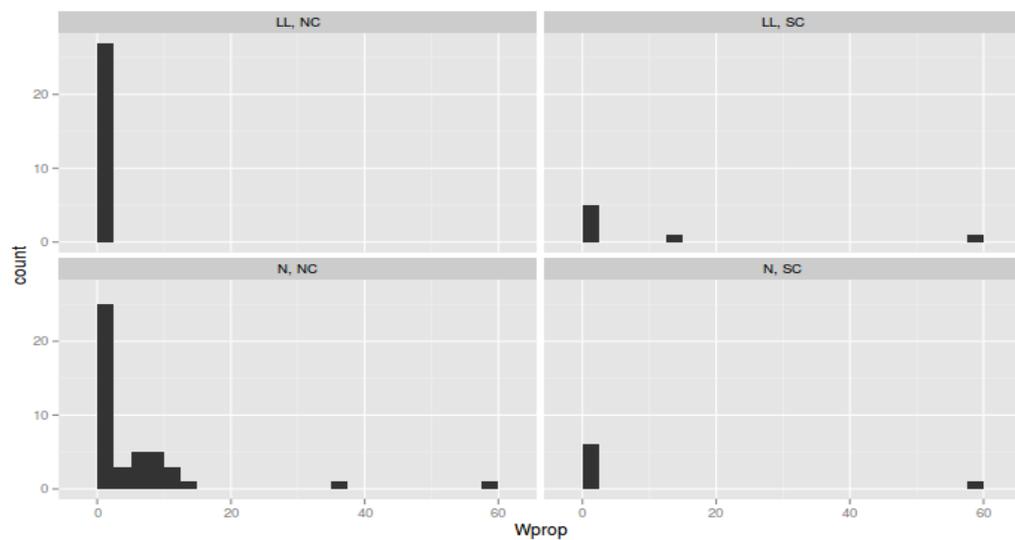
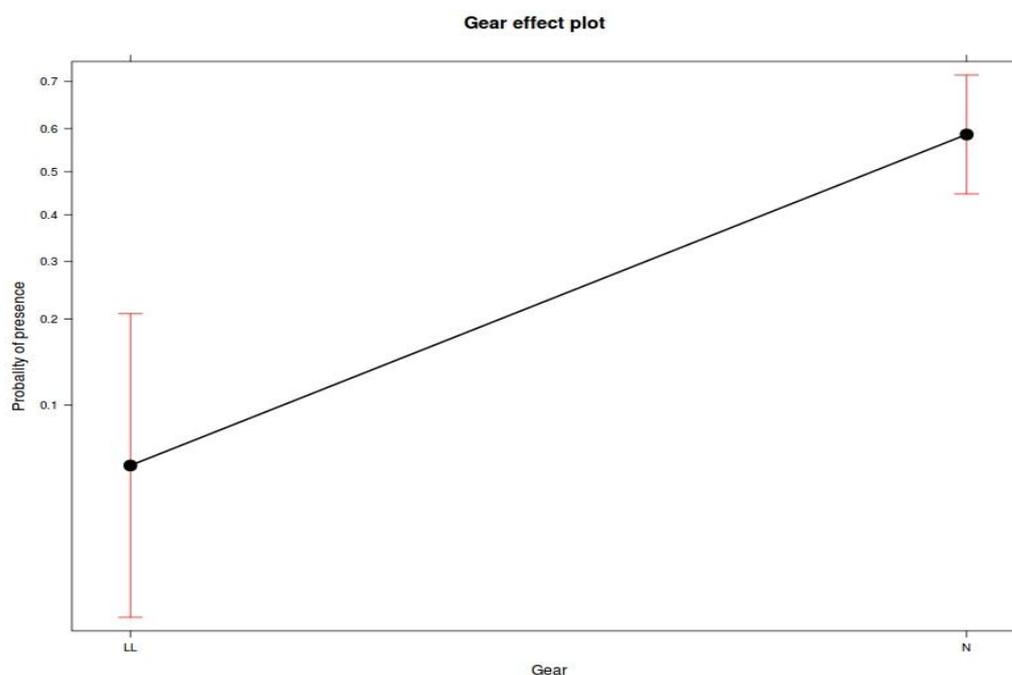


Fig. 2. Frequency of the observed weight proportions (%) of alien species in the catches, by gear and area. N=nets, LL=longlines, NC=North Crete, SC=South Crete.

The analysis of deviance table of the applied binary model indicated that only the Gear effect was significant (Table 1). The estimated probability of catching invasive species with nets was 58%, while that of long-lines was less than 10% (Fig. 3).

Table 1. Analysis of deviance table of the applied GLM model.

	Df	Deviance Resid.	Df	Resid. Dev.	Pr (>Chi)
Null			84	112.593	
Gear	1	28.2754	83	84.317	<0.001
area	1	0.1584	82	84.159	0.691

**Fig. 3.** Estimated GLM probabilities of catching alien species with nets (N) and long-lines (LL). Vertical lines indicate the corresponding 95% confidence intervals.

4. Conclusions/Discussion

The results indicate that the alien species are frequently caught on the coastal fishing gears in the area of Crete and in some cases compose a large proportion of the catches. They are more frequently caught on nets, than on longlines. Although the data from the southern part of Crete are limited to allow for definite conclusions, it seems that the longline catches of that area may include relatively high proportions of invasive species. This can be attributed to the higher abundance of the species *L. sceleratus* (Peristeraki et al., 2013) which is the main alien species caught in longlines (unpublished data).

Though preliminary, our results show that the alien species form a non-negligible part of the coastal fishery catches in the area, indicating that they are well established in the marine ecosystem of Crete. Further monitoring of the catches of alien species will give the opportunity to study their variation in a more refined gear and area scale including also temporal patterns.

5. References

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