DEPTH AND MESH SIZE EFFECT ON DISCARDING PRACTICES IN TRAMMEL NET FISHERY

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Abstract
Trammel nets are one of the most commonly exploited gears of small scale fisheries used all along the Greek coasts and in Mediterranean. However, knowledge on the discards of this gear is scarce. Discards in trammel net fishery include species with no commercial value, or commercial species, which cannot be distributed in the market because of their small size, or because they come on board already destroyed. The mesh size of the nets and depth of fishing operations are two factors affecting the proportion of the discards.
Keywords: Fisheries, Ionian Sea

Introduction
In general, the coastal fisheries gears are highly species and size selective. The unwanted catches are limited and consequently, the proportion of the fish discarded is low in each fishing operation. Discards in trammel net fishery include species with no commercial value, or commercial species, which cannot be distributed in the market because of their small size, or because they come on board destroyed by polychaetes or other marine organisms while the nets remain into the sea [1]. However, the extended use of the trammel nets by numerous vessels could account for a significant quantity of discards. The aim of this work was to study the discarding practice of trammel nets and the effects of the mesh size, depth and soaking time on the amount of the discards produced.

Material and Methods
Experimental fishing trials with trammel nets of different inner/outer mesh size combinations took place in the Ionian Sea (Greece), during June and July 2004. The mesh sizes used for the inner net were: 44, 56, 72 and 80 mm. The outer panels of the trammel nets had a stretched mesh size of 220, 280, 360 and 400 mm, respectively. All nets were made up of sheets of the four mesh sizes joined end to end to make up a fleet and arranged in random order. Total net length for each mesh size was 500 m. A total of 76 sets of nets were deployed at depths ranging from 10 to 130 m. Normal fishing practices were followed. The nets were set during sunrise and retrieved the following morning, with a soaking time of around 20 h. After hauling, the catch was removed and analyzed separately for each net.
The analysis of the discards was carried out using the logistic regression model. A binomial GLM was used to assess the effect of the soaking time, depth and mesh size on the discard probability, first for all the specimens of all the species caught (n=2144) and then for three of the most abundant species. The goodness of fit was tested using le Cessie-van Houwelingen-Copas-Hosmer test [2] [3] and the ROC (Receiver Operating Characteristic) curve was used to describe the accuracy of diagnostic test.

Results and Discussion
Out of the three covariates used in the logistic regression model for all the specimens of all the species caught, only the depth appeared significant (Tab.1). The le Cessie-van Houwelingen-Copas-Hosmer test (p=0.77, under the null hypothesis assumption that the estimated values by the model are similar to those observed) confirmed that the model fitted the data well.

Tab. 1. Estimates, standard error, and p-value of covariate for the logistic model (*significant at 0.05 critical p-value)

		Logistic model-binomial distribution		
response variable	covariate	estimate	SE	p-value
specimens discarded	Mesh size (mm)	-0.008	0.004	0.06
	Depth (m)	-0.02	0.003	0.05*
	Soaking time (h)	-0.02	0.02	0.44

The regression model showed that the probability of the discard of specimens decreased by about 10% from 10 to 120 m depth (Fig.1A). Although the depth was significant for the logistic model, the area under the ROC curve was 0.52, so the discrimination capacity of the model was very low (Fig. 1B). The same logistic regression model was used to assess the probability of discarding for *Sciaena umbra*, *Merluccius merluccius* and *Pagellus erythrinus*. For *S. umbra* the model showed that only the mesh size was significant: the discard probability using the 44 mm mesh size was greater than for the 72 and 80 mm. For *M. merluccius* and for *P. erythrinus* no covariates were significant.

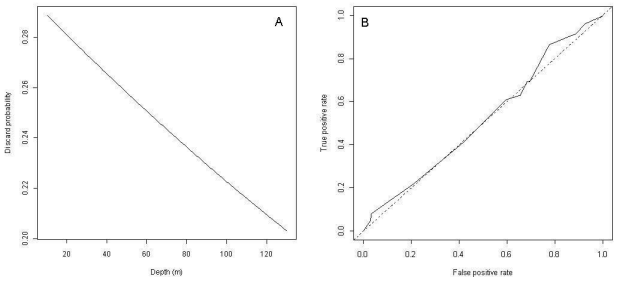

Fig. 1. A) The discards probability estimated as a function of depth by the logistic regression model. B) Receiving operating characteristic (ROC) curve of the predicted discards probability for the specimens caught

The logistic regression analysis showed that, for all the specimens of all the species caught, depth was a significant factor in determining the discard probability: increasing depth decreased the probability of specimens discarded. However depth did not completely explain the discard levels, which were probably related to other factors, such as the presence of scavengers feeding on them (i.e. Polychaetes), the weather conditions and the way of fish capture in the nets. The mesh size was significant in determining the discard levels of *Sciaena umbra*: the smallest mesh size implied more discard probability. In this case the use of larger inner panel mesh sizes could reduce the discard level of the species and could also reduces the handling time spent on board in removing the specimens from the nets.The soaking time did not affect the commerciality of the specimens caught, maybe due to the small difference of this factor between the hauls.
In conclusion this study shows that the depth and the inner panel mesh size affect the discard levels in trammel nets fishery but are not enough to explain them completely; in addition the importance of these factors on discard levels varies by species.

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