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Size selection of *Nephrops norvegicus* (L.) in commercial creel fishery in the Mediterranean Sea

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ABSTRACT

In the Mediterranean Sea *Nephrops* (*Nephrops norvegicus*) is predominantly caught with bottom trawls, but it is also harvested with creels. While the size selection of *Nephrops* in bottom trawls is well documented, there is no previous information on creel size selection for this species. Therefore, sea trials were carried out to assess the selective properties of commercial creels with 41 mm mesh size netting mounted as a square mesh netting as prescribed by the legislation. Creel size selection was assessed for *Nephrops* and two main crustacean bycatch species: mantis shrimp (*Squilla mantis*) and blue-leg swimming crab (*Liocarcinus depurator*). The influence of the soak time on creel selectivity was also investigated, and no significant difference was detected between one and two day soak times. The average carapace length of a crustacean with 50% probability of being retained (L50) was 31.69 mm for *Nephrops*, which is 59% larger than the minimum landing size (MLS) set by the fishery regulation, therefore demonstrating a mismatch between MLS and gear selectivity in this fishery. Comparison of creel selectivity obtained in our study with the historical results obtained from commercial bottom trawl selectivity studies for *Nephrops* in the Mediterranean Sea demonstrated that the creel L50 was significantly higher than in the trawl fishery, this implies that creel fishery is targeting larger *Nephrops* than trawl fishery.

1. Introduction

Nephrops (Nephrops norvegicus) is the most valuable crustacean species caught in the EU waters, targeted by both bottom trawl and creel commercial fishery (Leocádio et al., 2012). Total annual catch in the Mediterranean varied from 2470t to 5752t in the last decade (EUROSTAT, 2017: http://ec.europa.eu/eurostat/data/database). *Nephrops* is mainly targeted by bottom trawlers and the size selection of trawls for *Nephrops* in the Mediterranean Sea is well documented (Sardà et al., 1993; Guijarro and Massutì, 2006; Sala et al., 2008; Sala and Lucchetti, 2010).

With the recent reform of Common Fisheries Policy (CFP), EU encourages alternative types of fishing methods that increase size and species selectivity or minimise the negative impact of fishing activities on the marine environment (Regulation (EU) No 1380/2013). One of such alternatives is fishing with creels, which are generally considered as a fishing gear with low impact on the non-target species (Eno et al., 2001; Morello et al., 2009) and benthic fauna in general (Eno et al., 2001; Adey, 2007; Johnson et al., 2013). Other advantages of creel fishing for *Nephrops* include reduced quantity of the discards (Eno et al., 2001; Morello et al., 2009) and higher market value, usually because individuals are larger and in better condition (Eriksson, 2006; Ridgway et al., 2006). The availability of *Nephrops* to trawls is known to be dependent on their burrow emergence rhythms and therefore an efficient harvesting requires synchronization with *Nephrops* diel activity (Aguzzi and Sardà, 2008; Morello et al., 2009; Katoh et al., 2013). For the creel fishery to be effective, the creels need to be soaked for at least one day to cover the dial periods with high activity for *Nephrops*.

In Croatia, creel fishery for *Nephrops* is open throughout the year in all fishing zones, but in practice it is confined to the internal waters during the period when trawling is prohibited in the area. The creels are set in a longline system from small artisanal vessels, with minimal allowed mesh size of either 36 mm or 40 mm, depending on the fishing zone (Anonymus, 2015).

The creel capture process involves attracting the target species, luring it inside using the bait and keeping it in captivity until the retrieval. Once inside the creel, *Nephrops* can escape if they are small enough to exit through the creel meshes. The main goal of this study

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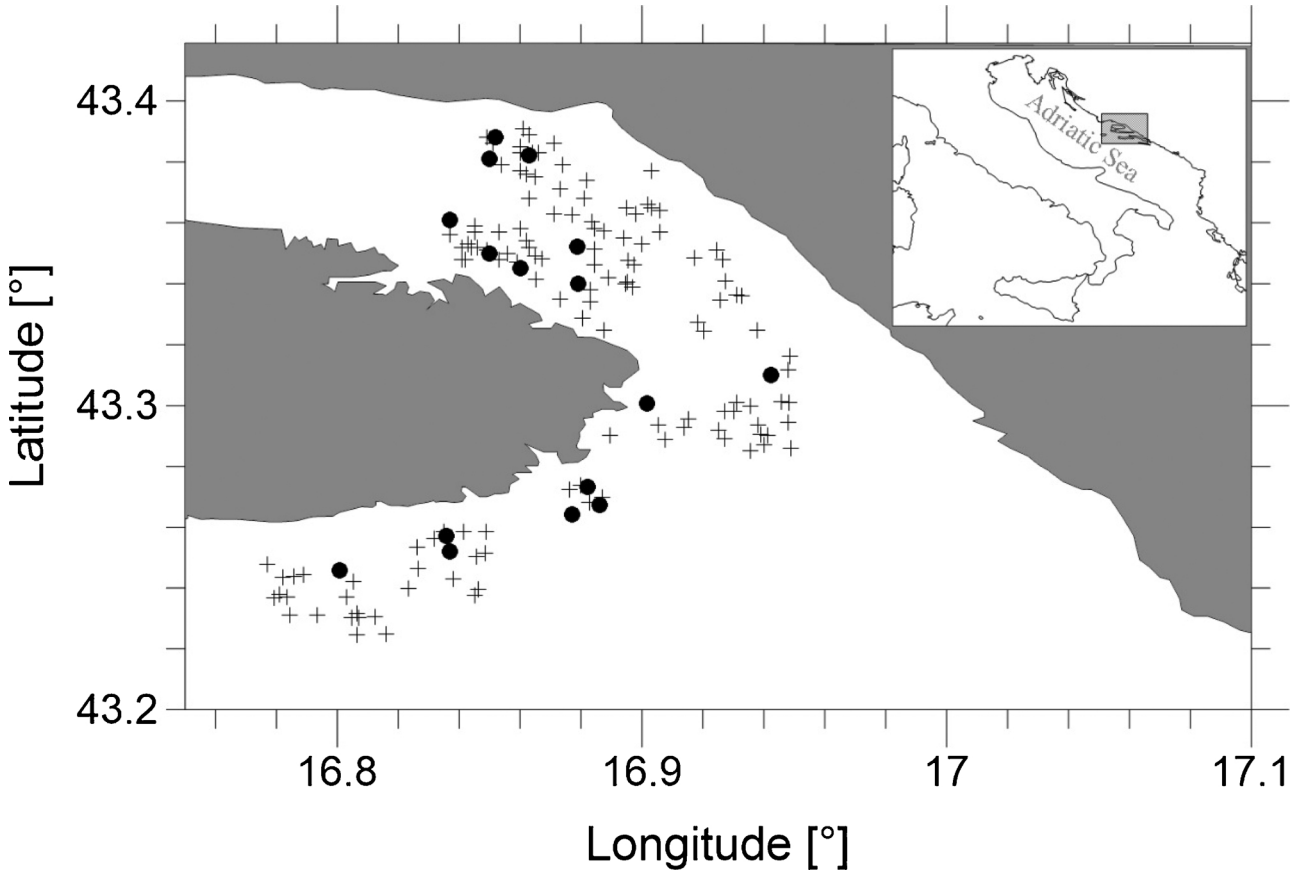

Fig. 1. Map of the sampling area showing position of test (crosses) and control (circles) creel sets.

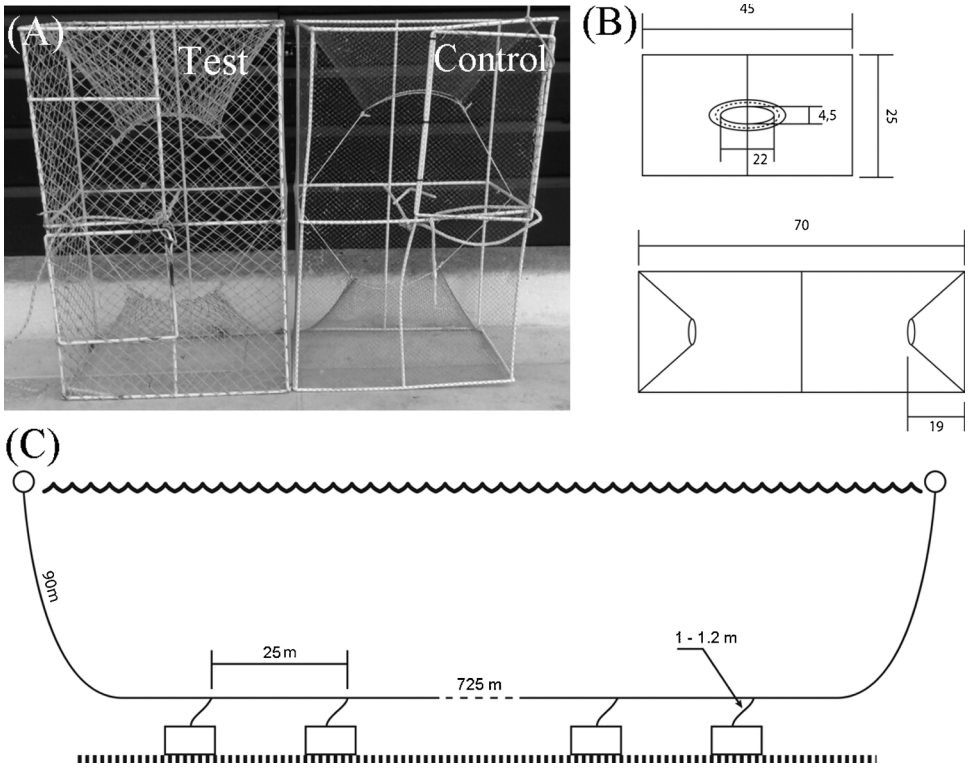

Fig. 2. Photo (A) and technical drawing of the creels (B) used in the study and the illustration of the deployment in the longline system (C).

was to estimate the size selectivity of commercial creels targeting *Nephrops* in the Mediterranean Sea and to investigate if the creel size selectivity is well balanced with the *Nephrops* minimum landing size. From the previous study conducted by Morello et al. (2009) in the Adriatic Sea, we know that the size distributions of *Nephrops* caught by creels and the bottom trawl targeting *Nephrops* differs, indicating that