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IMPACT OF TRAWLING ON DEMERSAL COMMUNITIES AND PRODUCTIVITY OF FISHERY RESOURCES IN SICILIAN WATERS

IMPATTO DELLA PESCA A STRASCICO SU COMUNITÀ DEMERSALI E PRODUTTIVITÀ DELLE RISORSE DA PESCA NELLE ACQUE SICILIANE

Abstract - *Comparing areas subject to different fishing pressures is one of the approaches used to assess the impact of trawling on demersal communities. The present research aimed at assessing the impact of bottom trawling disturbance on demersal communities. In particular, new data on richness and biodiversity of demersal communities, and abundance and demography of the main target species exploited by demersal fisheries in two areas subject to different trawling effort were collected. The results obtained confirm the impact of trawling on specific richness and biodiversity of communities and, except for European hake, on the bony fish component of demersal resources. Given the increasing concerns towards the protection of ecologically critical areas, the information here presented contributes to the identification of spatially based management measures for fisheries that balance conservation needs with those of productive use of marine resources.*

Key-words *– trawling impacts, demersal community, resources, productivity, Strait of Sicily*

Introduction – It is known that trawling activities can alter the structure and functioning of benthic marine ecosystems (Buhl-Mortensen *et al.,* 2016). Such modifications include damage to biogenic habitats (Rijnsdorp *et al*., 2020), disruption of demersal trophic webs (Hiddink *et al*., 2011) and direct and indirect mortality of benthic organisms (Sciberras *et al*., 2018). The impact of trawling varies depending on seafloor characteristics and local physical disturbance regime. This research aims to assess the impact of trawling on demersal communities, including epimegabenthic component of the biocoenoses characterising the two study areas within the ISPRA-CNR IRBIM Convention for the implementation of the Marine Strategy Directive (2008/56/EC).

Materials and methods – Two areas of the Strait of Sicily were identified, similar in bathymetry being the central axis of both areas coincident with the bathymetry of -50 m and sedimentary facies, mostly constituted of coastal terrigenous mud (VTC), but under different trawling effort regime (*e*): area L (44-56m) with low *e*, within northern sector of the Fishery Restricted Area (FRA) of the Gela Basin established by the General Fisheries Commission for the Mediterranean (GFCM), and area H (41-54m) with high *e* (Fig. 1). Nine standardised trawl hauls were conducted on each of the two investigated areas in December 2020, through which information was acquired on the specific richness and biodiversity of the demersal communities, as well as abundance and biometrics for the main species collected. Catches were classified to the greatest possible taxonomic detail and abundance indices (as number and weight) per trawl hour were calculated for all detected taxa. R software was used for data analysis and graphics. Specific richness (Margalef) and diversity (Shannon and Pielou) indices were also calculated. Disturbance in the two areas was evaluated by the classical Abundance Biomass Comparison curves (ABC). Individual biometrics of the main species targeted

(*Parapenaeus longirostris* (Lucas, 1846) - DPS, *Mullus barbatus* (Linnaeus, 1758) - MUT and *Merluccius merluccius* (Linnaeus, 1758) - HKE) or discarded (*Trachurus trachurus* (Linnaeus, 1758) – HOM) in the areas were also recorded.

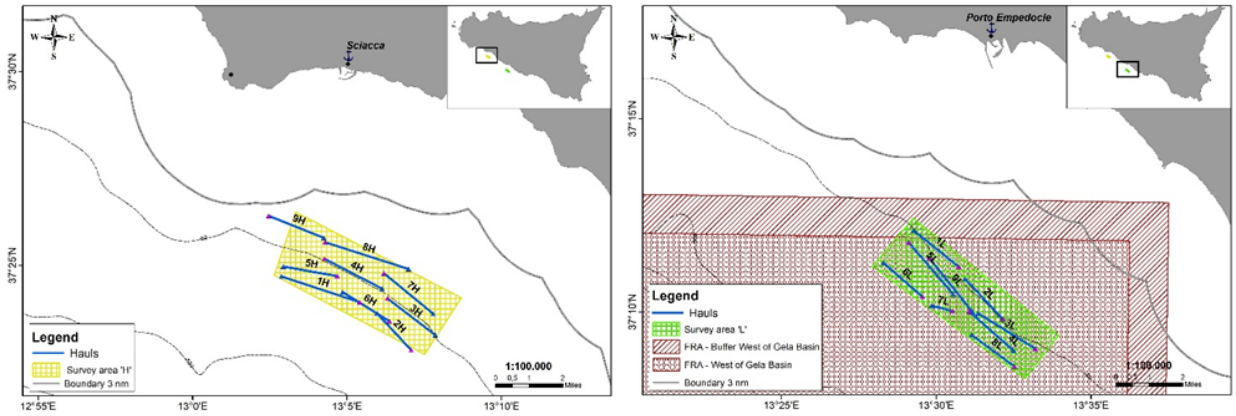
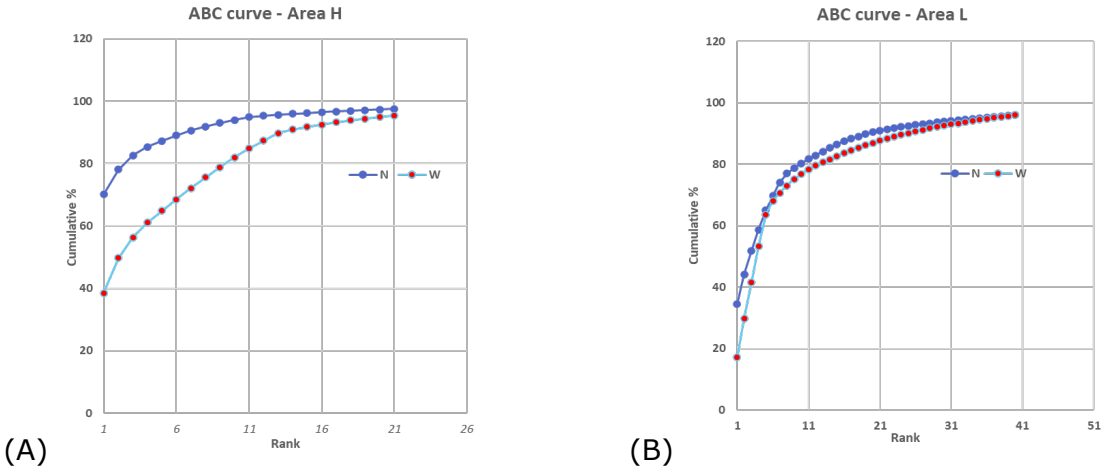


Fig. 1 - Bathymetric maps of the 2 investigated areas with routes of the 18 experimental hauls performed in area H (left) and area L (right).
Carta batimetrica delle 2 aree d'indagine con le rotte delle 18 pescate sperimentali condotte nell'area H (a sinistra) e nell'area L (a destra).

Results and discussion - In general, area L showed greater number of species and biodiversity than area H (data not shown). In addition, the abundance curve (N) in area H was much higher than the biomass curve (W), indicating a more disturbed state of the demersal community than in area L (Fig. 2).



(A) (B)

Fig. 2 - Comparison between abundance (N) and biomass (W) (Abundance Biomass Comparison, ABC curves) between area H (A) and area L (B).
Confronto tra abbondanza (N) e biomassa (W) (Abundance Biomass Comparison, ABC curve) tra l'area H (A) e l'area L (B).

The frequency distributions for size classes of DPS, HOM and MUT show significantly larger sizes in area L than in area H (one-tailed Kolmogorov-Smirnov test; $p<0.05$) while HKE showed no significant differences (Fig. 3).

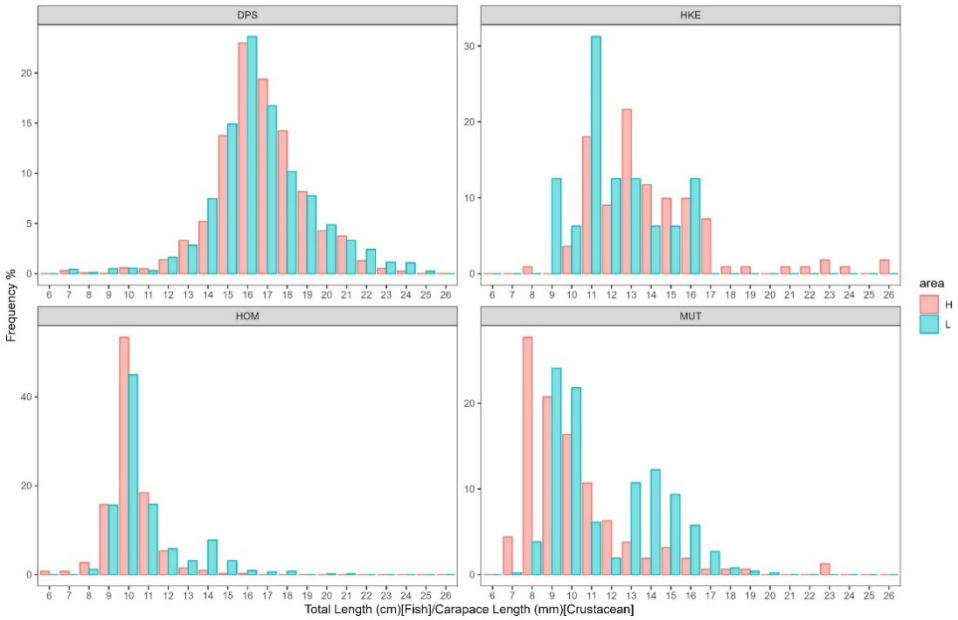


Fig. 3 - Frequency distribution by size classes of *P. longirostris* (DPS; N(L)=1489, N(H)=4552), *M. merluccius* (HKE; N(L)=16, N(H)=113), *T. trachurus* (HOM; N(L)=663, N(H)=356) and *M. barbatus* (MUT; N(L)=485, N(H)=65) expressed as percentage.
Distribuzione di frequenza per classi di taglia di P. longirostris *(DPS; N(L)=1489, N(H)=4552),* M. merluccius *(HKE; N(L)=16, N(H)=113),* T. trachurus *(HOM; N(L)=663, N(H)=356) e* M. barbatus *(MUT; N(L)=485, N(H)=65) espressa in percentuale.*

In terms of numbers and weight, MUT, HOM and Pandora (*Pagellus erythrinus* (Linnaeus, 1758)) (data not shown) were found to be significantly more abundant in area L than in area H (Kruskal-Wallis test; $p < 0.05$), which is characterised by higher abundances of HKE. Although statistically significant only in numbers, a higher abundance was found in area H of DPS, a shrimp characterised by rapid growth and precocious sexual maturity (Fig. 4).

Conclusions - The results obtained confirm the general effects of trawling in reducing the specific richness and biodiversity of demersal communities and the abundances and sizes of the main commercial fish species. On the other hand, if the observed increase in DPS abundance in the heavily trawled area can be explained by a reduction in competition and predation associated with fishing activities, the causes of the recorded increase in abundance of HKE are less clear. This may have been influenced by the high abundance of DPS, a known prey of HKE, in area H. The information presented, although limited in time and space, can contribute to the identification of spatially-based fisheries management measures that balance conservation needs with those of productive use of fishery resources.

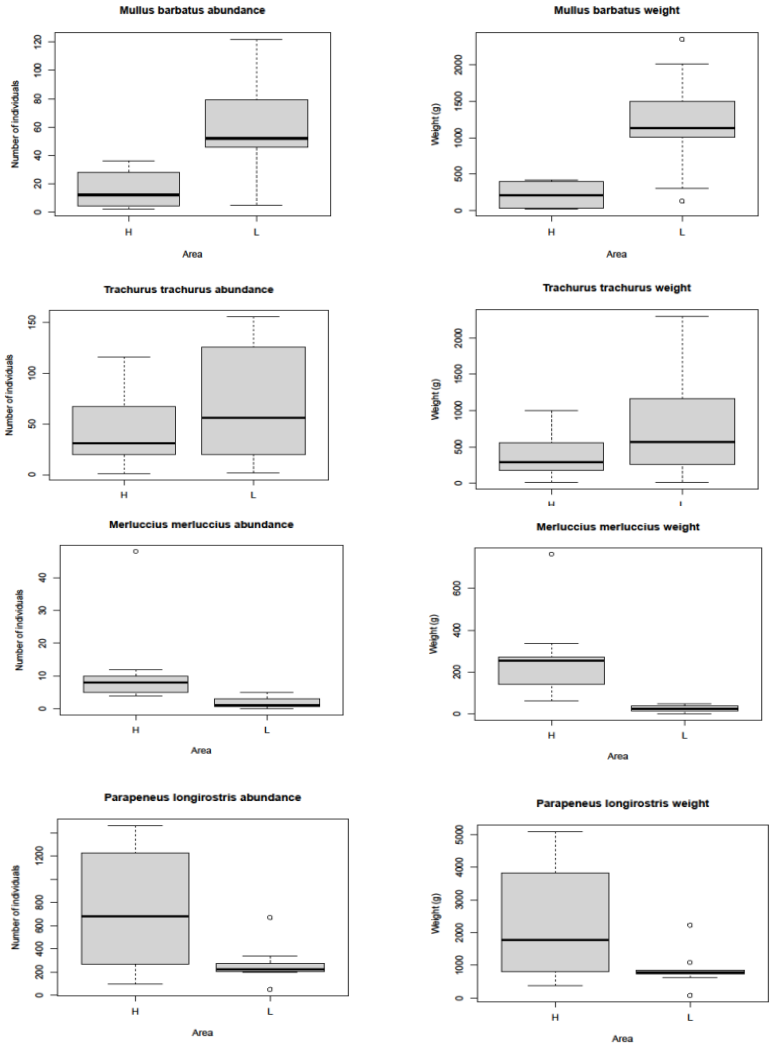


Fig. 4 - Boxplots of abundance (N) and biomass (W) of the investigated species in the H and L areas. *On the left* are the abundances expressed as the number of individuals; *on the right* they are expressed as the total weight (g) of the individuals of the species.
Boxplot di abbondanza (N) e biomassa (W) delle cinque specie nelle aree H e L. A sinistra sono riportate le abbondanze espresse come numero di individui; a destra sono espresse come peso (g) totale degli individui della specie.

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