Biol. Mar. Mediterr. (2026), 30 (1): 35-38 www.biologiamarinamediterranea.it

54° Congresso SIBM: Biodiversità e impatti sulle specie in Mar Mediterraneo

G. COSTANTINO[1], L. CASCIARO[1,2], A. CONSIGLIO[1,2], C. NEGLIA[1,2], W. ZUPA[1,2], P. CARBONARA[1,2]

[1] COISPA Tecnologia e Ricerca s.c.r.l., Via dei Trulli, 18/20 - 70126 Torre a Mare (BA), Italia.
[2] Fondazione COISPA ETS, Via dei Trulli, 18/20 - 70126 Torre a Mare (BA), Italia.
corresponding author: costantino@coispa.eu

PENNATULIDAE (CNIDARIA, ANTHOZOA) FROM SOUTHERN ADRIATIC SEA (GSA 18): DISTRIBUTION AND ASSOCIATED BIODIVERSITY

PENNATULIDAE (CNIDARIA, ANTHOZOA) DEL MAR ADRIATICO MERIDIONALE (GSA 18): DISTRIBUZIONE E BIODIVERSITÀ ASSOCIATA

Abstract *– A total of 219 specimens of three pennatulacean species from the Southern Adriatic Sea (Geographic Sub-Area, GSA 18), namely* Pennatula rubra *(120),* P. phosphorea *(49), and* Pteroeides griseum *(50), were collected during the Mediterranean International Bottom Trawl Survey (MEDITS) over the 2011–2023 period. The three species were predominantly distributed on the eastern side of the study area (Albania, Montenegro), particularly on the continental shelf at depths of 62-112 m. Biodiversity analysis showed higher values for faunal communities associated with pennatulaceans than for those not associated. This study contributes to a better understanding of the distribution of pennatulaceans species in the Southern Adriatic Sea and supports strategies aimed at preserving VME habitats.*

Keywords*: Pennatulidae, distribution, Southern Adriatic Sea, biodiversity, VME*

Introduction – Pennatulaceans are a highly specialized group of anthozoans that colonise soft, muddy, and sandy sediments of the continental shelf, acting as key bio-structural components that enhance habitat complexity and contribute to increased biodiversity (Abdelsalam, 2014; Bastari *et al.*, 2018). The important ecological role and vulnerability to human activities, such as trawling, have led to the classification of "sea pen and burrowing megafauna communities" as Vulnerable Marine Ecosystems (VMEs) by the FAO-GFCM (FAO-GFCM, 2023). In particular, the three considered species, *Pennatula rubra* Ellis, 1764, *Pennatula phosphorea* Linnaeus, 1758 and *Pteroeides griseum* (Bohadsch, 1761), have been classified as "DD" (Data Deficient) species on the IUCN Red List (Salvati *et al*., 2014). Globally, scientific literature on the distribution and ecology of sea pens is relatively scarce, particularly in the Mediterranean Sea (Bastari *et al.*, 2018). Furthermore, very few works address the Southern Adriatic Sea compared to the central-northern basins. This study focuses on the spatial abundance and distribution of these pennatulaceans and the biodiversity of the associated faunal community in the Southern Adriatic Sea (GSA 18), using data from the Mediterranean International Bottom Trawl Survey (MEDITS), conducted over the 2011-2023 period.

Materials and methods – Annually, a total of 70-95 hauls were carried out in the spring-summer period, between 10 and 800 m deep, along the coasts of Italy, Albania and Montenegro in the context of trawl survey MEDITS (Spedicato *et al.,* 2019). For each haul, the swept area was estimated using sensors (SIMRAD), and all species caught were classified, weighed, and counted directly on board. In addition, some samples were collected and soon stored on board (-20 °C) for subsequent analysis in the laboratory. The collected specimens were transferred to the laboratory for biometric measurements and taxonomic checks (Williams, 1995; López-Gonzales *et al.*, 2001; Chimienti *et al*., 2015). Abundance maps (N/km^2 and kg/km^2), bathymetric distribution (% and density), and historical analysis of abundance and occurrence indexes (% positive hauls) for all three species were conducted using the BioIndex R package (https://github.com/COISPA/BioIndex). The Margalef alpha-diversity index was estimated and compared within macrofaunal groups (Cephalopods, Crustaceans, Osteichthyes, Chondrichthyes, Macrobenthos), distinguishing between taxa

ASSOCIATED (AS) and NOT-ASSOCIATED (NAS) to the presence of pennatulaceans. Similarity Percentages analysis (SIMPER) was conducted to evaluate the contribution of each species to the overall dissimilarity between faunal groups. Analysis of Similarities (ANOSIM) was also performed to highlight differences between the two groups in relation to their specific composition. More specific biometric measures were carried out on *Pennatula rubra* specimens collected during the recent MEDITS trawl surveys (2023-2024, Albania and Montenegro) and the monitoring of the commercial fleet (DCF) (2022, Italy). Total length (mm), maximum width (mm), rachis length (mm), peduncle length, wet weight (g), polyp leaves (N/side), total length of axis (mm), thickness of axis (mm), to highlight correlation between themselves (Chimienti *et al.*, 2018).

Results – In the considered survey period, 50 specimens of *P. griseum*, 49 of *P. phosphorea* and 120 of *P. rubra* were collected. Both abundance and biomass map analyses show a clear and consistent prevalence of these species along the Albanian and Montenegrin coasts, and a clear rarefaction along the Italian coasts (Fig. 1).

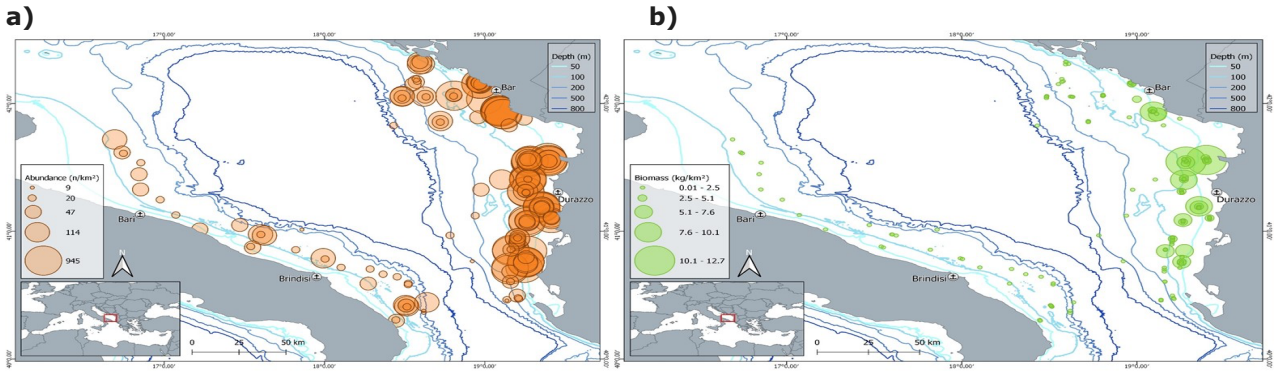

Fig. 1 - Abundance (N/km^2) (a) and biomass (kg/km^2) (b) maps of the collected pennatulaceans.
Mappe di abbondanza (N/km^2) (a) e di biomassa (kg/km^2) (b) dei pennatulacei raccolti.

The abundance mean value was 118.77±175.38 N/km^2 and 1.45±2.14 kg/km^2 for the biomass. The highest number of sea pens found (47 specimens, 94 m of depth) was observed in a haul located off the coast of Durres (Albania). The most frequent findings in the hauls were included in the 62-112 m bathymetric range. The minimum depth of occurrence was 14 m, while the maximum was recorded at 186 m. The stratified analysis of abundance also confirmed the most consistent presence of pennatulaceans species in the first three bathymetric strata (10-50 m, 50-100 m, 100-200 m), with a clear prevalence of the second one (Fig. 2). The percentage of positive hauls for the pennatulaceans presence did not show any significant trends. Furthermore, the drop of values in the 2020-2022 period (red circle in Fig. 3) is due to the partial lack of data for Albanian and Montenegrin coasts.

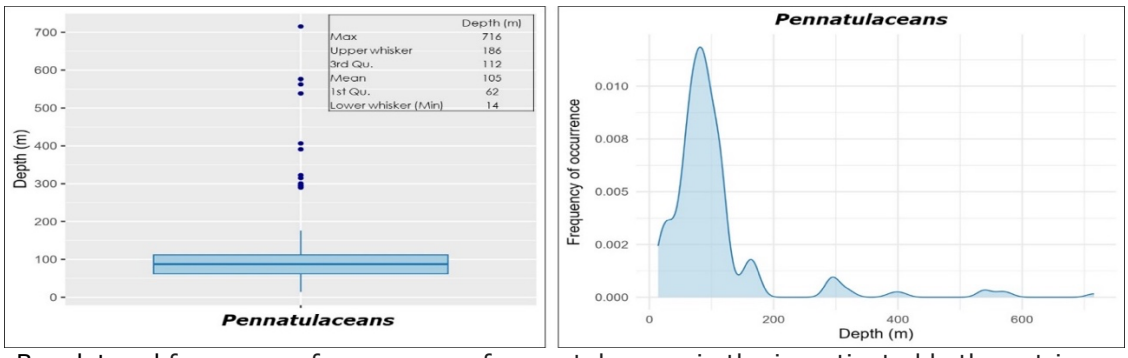

Fig. 2 - Boxplot and frequency of occurrence of pennatulaceans in the investigated bathymetric range.
Boxplot e frequenza di occorrenza dei pennatulacei nell'intervallo batimetrico indagato.

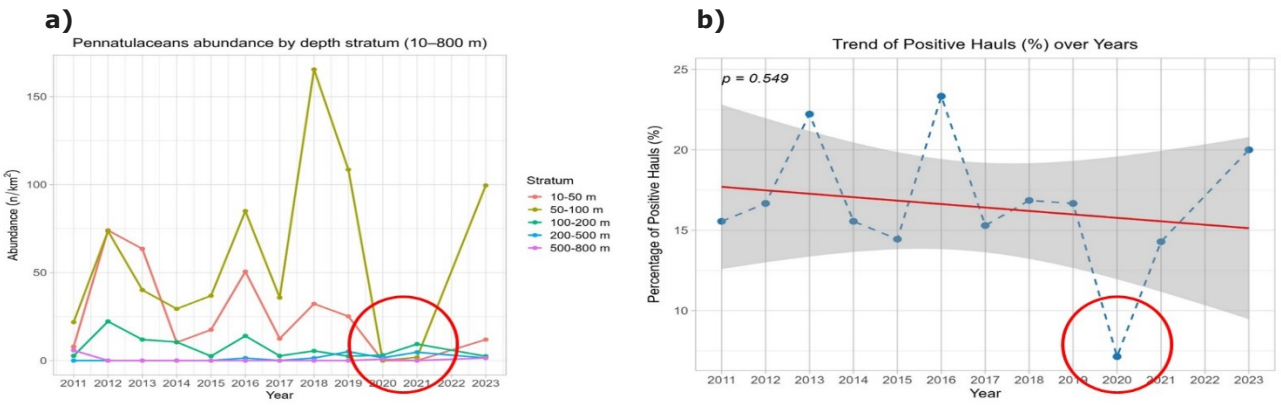

Fig. 3 - Abundance by stratum (a) and % of positive hauls (b) for the considered pennatulaceans species.
Abbondanza per strato (a) e % di cale positive (b) delle specie di pennatulacei considerate.

Following the highlighted bathymetric data and the selection of hauls within the 0-200 m range, a biodiversity analysis was carried out using commonly used indices. In all the elaborations, the values of the biodiversity of the ASSOCIATED groups were significantly higher than those NOT-ASSOCIATED, suggesting a likely influence of the pennatulacean presence on the faunal biodiversity (Fig. 4). Moreover, the SIMPER analysis carried out by Bray-Curtis index, highlighted how some species belonging to Osteichthyes and Chondrichthyes (*Spicara flexuosum* Rafinesque, 1810*, Lepidotrigla cavillone* (Lacepède, 1801), *Dentex macrophthalmus* (Bloch, 1791), *Scyliorhinus canicula* (L., 1758)*, Citharus linguatula* (L., 1758)), have a greater incidence on the separation between the above mentioned groups. Likewise, the ANOSIM highlights a significant dissimilarity between the two groups (P <0.05) in relation to their specific composition, greater than the difference within the two groups themselves.

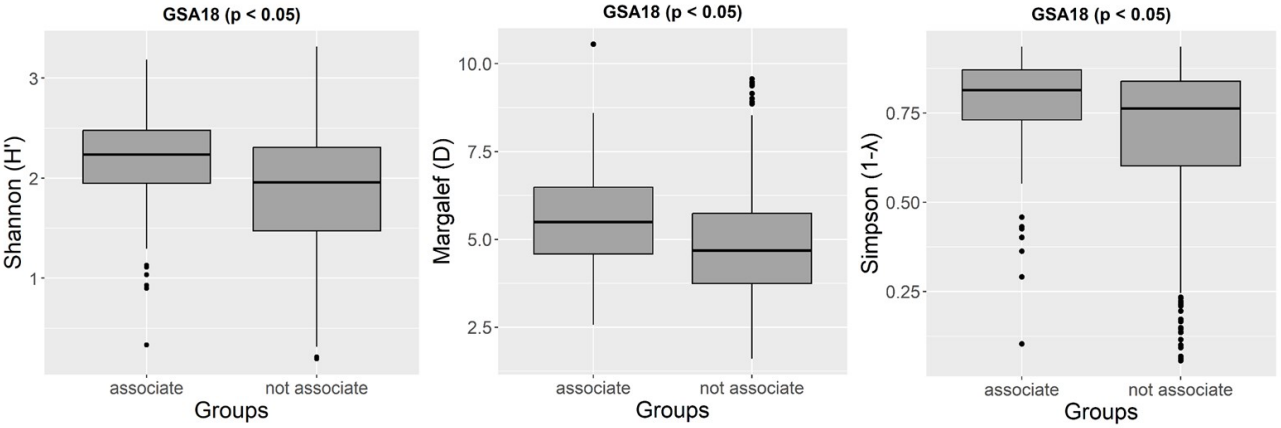

Fig. 4 - Biodiversity analysis carried out between the associated vs not-associated faunal groups.
Analisi della biodiversità condotta fra i gruppi faunistici associati vs non-associati.

47 specimens of *P. rubra* from 13 hauls carried out on the Italian, Montenegrin and Albanian (2022-2024) seabeds at depths between 59 and 195 m, were measured and dissected in the laboratory and subsequently analysed to identify biometric correlations. The most significant correlations were: rachis length vs total length (R^2=0.93); wet weight vs total length (R^2=0.77); wet weight vs rachis length (R^2=0.74); peduncle length vs total length (R^2=0.67).

Conclusions - This study represents an updated contribution to the knowledge on the distribution and abundance of *P. rubra, P. phosphorea* and *P. griseum*, classified as "Data Deficient" (DD in the Italian IUCN Red List – Salvati *et al*., 2014), in the muddy

and sandy-muddy bottoms of the Southern Adriatic platform (GSA 18), an area for which there is a very limited availability of scientific data (Bastari *et al.*, 2018). The greater abundance and density seem to be located mainly off the Albanian and Montenegrin coasts, whereas the presence along the Italian coasts appears much more limited, probably due to a greater incidence of trawling activities along the coasts of the latter (Zupa *et al.,* 2025). The analysis of faunal biodiversity suggests a positive influence of pennatulaceans, with values tending to be higher for AS taxa than for NAS taxa. The ANOSIM analysis highlights greater dissimilarity between the two groups than within them, as further corroborated by the SIMPER analysis, which mainly attributes the differences between the groups (AS vs NAS) to some Osteichthyes and Chondrichthyes species previously mentioned, which usually frequent the sea pen bottoms for reproductive and feeding purposes. The processing of morpho-biometric data carried out on a few dozen specimens of *P. rubra*, endemic species of the Mediterranean basin and of particular ecological and conservation interest (Williams, 1995), has highlighted and confirmed some significant correlations, that are also useful for the application of inferential methods, e.g. by ROV direct observations (Chimienti *et al.*, 2018), also stimulating the prospect of increasing data collection, aimed at specific studies in terms of growth times and age of the species.

References

ABDELSALAM K.M. (2014) - Faunistic study of benthic Pennatulacea (Cnidaria, Octocorallia) from the Northern coast of Egypt. *Egypt. J. Aquat. Res.*, **40**: 261-268.

BASTARI A., PICA D., FERRETTI F., MICHELI F., CERRANO C. (2018) - Sea pens in the Mediterranean Sea: habitat suitability and opportunities for ecosystem recovery. *ICES Jour. of Mar. Sci.*, **75** (5): 1722–1732.

CHIMIENTI G., MAIORANO P., MASTROTOTARO F. (2015) - *Pennatula rubra* facies in the Ionian Sea (Central Mediterranean*). Biol. Mar. Medit.,* vol. **22** (1): 76–80.

CHIMIENTI G., ANGELETTI L., RIZZO L., TURSI A., MASTROTOTARO F. (2018) - ROV vs trawling approaches in the study of benthic communities: the case of *Pennatula rubra* (Cnidaria: Pennatulacea). *J. Mar. Biol. Assoc. U.K.*, vol. **98** (8): 1-11. Available at: https://doi.org/10.1017/S0025315418000851.

FAO-GFCM, (2023) - Report of the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH). FAO Headquarters, Rome, Italy, 07–10 March 2023, pp: 1-41 Available at: https://www.fao.org/gfcm/technical-meetings/detail/en/c/1636791/.

LÓPEZ-GONZÁLEZ P. J., GILI J. M., WILLIAMS G. C. (2001) - New records of Pennatulacea (Anthozoa: Octocorallia) from the African Atlantic coast, with description of a new species and a zoogeographic analysis. *Sci. Mar.,* **65** (1): 59-74.

SALVATI E., BO M., RONDININI C., BATTISTONI A., TEOFILI C. (2014) - *Lista Rossa IUCN dei coralli italiani.* Comitato italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma: 40 pp.

SPEDICATO M.T., MASSUTÍ E., MÉRIGOT B., TSERPES G., JADAUD A., RELINI G. (2019) - The MEDITS trawl survey specifications in an ecosystem approach to fishery management. Sci. mar. **83** (S1): 9-20. Available at: https://scientiamarina.revistas.csic.es/index.php/scientiamarina/article/view/1829

WILLIAMS G.C. (1995) - Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopsis. *Zool. J. Linn. Soc. London*, **113**: 93-140.

ZUPA W., CARBONARA P., BITETTO I., CASINI M., MAIORANO P., D'ONGHIA G., ISAJLOVIC I., SPEDICATO M.T., VAN HOEY G., RINDORF A. (2025) - Relative benthic status guides sustainable trawl management in the Adriatic–Ionian Seas. *ICES Journal of Marine Science*, Vol. **82** (8), fsaf148. Available at: https://doi.org/10.1017/S0025315418000851.