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Special Section: The new Checklist of the Italian Fauna

The conventional limits of the marine biogeographical Sector 4, for the new Checklist of the Italian Fauna

Salvatore GIACOBBE[1,*], Marco OLIVERIO[2]

[1] *Dipartimento di Scienze Chimiche, Biologiche, Farmaceutiche e Ambientali, Università di Messina, Via Stagno d'Alcontres 31, 98166 Messina, Italy*
[2] *Dipartimento di Biologia e Biotecnologie 'Charles Darwin', Sapienza Università di Roma, Zoology, Viale dell'Università 32, 00185 Roma, Italy*

* *corresponding author, email: salvatore.giacobbe@unime.it*

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SUMMARY

The status of a distinct biogeographical sector for the area of the Strait of Messina has been widely acknowledged in the last two decades. However, clear-cut limits of this sectors have never been formalised. With the understanding that in nature the limits of biogeographical sectors are usually not clear-cut, and for the sake of unequivocally placing occurrences in this sector we have here: (1) summarized the history of the classification of the Strait of Messina as a biogeographical sector, and (2) provided new formal limits of Sector 4, as far as possible reflecting main ecological properties of the area and recognizable discontinuities with the neighbour sectors.

INTRODUCTION

The Scientific Committee for the Italian Fauna (Comitato Scientifico per la Fauna d'Italia, hereinafter referred to as CSFI) is coordinating the production of the new updated Checklist of the Italian fauna, with the support of the Italian national node of the LifeWatch European Research Infrastructure Consortium (LifeWatch ERIC) (Bologna et al., 2022). The geographic

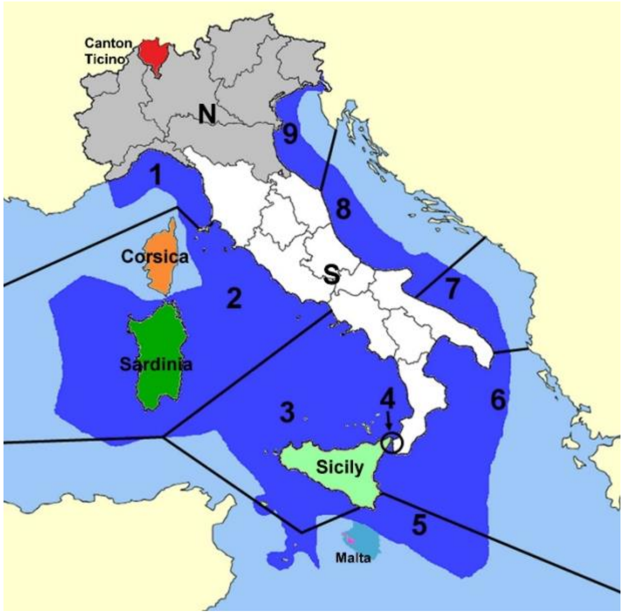

Figure 1. Geographical setting of the new Checklist of the Italian fauna. Terrestrial and freshwater sectors: **Canton Ticino** (s.l., including Val Mesolcina, red); **N**, northern continental macro-region (grey); **S**, southern peninsular macro-region (white); island macro-region, divided in the previous checklist into **Sicily** (light green) and **Sardinia** (dark green); **Malta** (pink); **Corsica** (orange). Marine sectors, with the Italian Economic Exclusive Zone in blue: **1**, Ligurian Sea (s.l.); **2**, northern Tyrrhenian, including the sea around Corsica and Sardinia; **3**, southern Tyrrhenian, including the sea around northern and southern Sicily and Pantelleria Is.; **4**, Messina Strait; **5**, southern Mediterranean, including the sea around south-easternmost Sicily and the Pelagie Islands, and the continental shelf around Malta (turquoise); **6**, Ionian; **7**, southern Adriatic; **8**, mid-Adriatic; **9**, northern Adriatic.

scope of the new checklist is partitioned, for the non-marine animals, in each of the three macro-regions (continental, peninsular and insular [Sicily and Sardinia] Italy, Fig. 1) and, optionally, in each of the 20 Italian administrative regions, the Republic of San Marino, Vatican City, Canton Ticino (Switzerland), Corsica (France) and Malta. For the checklists of marine species (e.g. Renda et al., 2022), which were based on records from the Italian Economic Exclusive Zone (as defined in Flanders Marine Institute [2019], but also including the Tyrrhenian coasts of Corsica and the continental shelf of the Maltese archipelago), the geographical units of marine and coastal waters refer to the nine biogeographical sectors identified in the checklist of the marine flora and fauna published by the Società Italiana di Biologia Marina, SIBM (Relini 2008, 2010), and largely based on the biogeographic sectors identified by Bianchi (2004).

For the sake of unequivocally placing occurrences in each of the nine marine biogeographical sectors, limits of sectors 1-3 and 5-9 were provided (including the addition of the Tyrrhenian coasts of Corsica to sector 2, and of the continental shelf around Malta to sector 5). However, for the smallest of the sectors (4: Strait of Messina), only the indication of “the area of the Strait between Sicily and Calabria” was provided. With the understanding that in nature the limits of biogeographical sectors are usually not clear-cut, there is however the need, for the compilation of occurrence datasets, to define clear conventional limits.

Therefore, we have summarized hereby the history of the classification of the Strait of Messina as a biogeographical sector; then, we provide the conventional limits of the sector, as far as possible reflecting the main ecological properties of the areas and recognizable discontinuities with the neighbour sectors.

Historical setting

The Strait of Messina (hereinafter referred to as SoM) is broadly located in the centre of the Mediterranean Sea, directly connecting the Tyrrhenian Sea (Western Mediterranean) with the Ionian Sea (Eastern Mediterranean). However, from an ecological point of view, it cannot be considered a transition area, nor does it identify a biogeographic borderline, having its own characteristics that make it different from both adjacent basins. Such anomaly is implicitly reported in Bianchi (2004), regarding the position of the boundary between the western and eastern Mediterranean. According to both Pérès & Picard (1964) and Bianchi & Morri (2000), the SoM (as well as the entire island of

Sicily) is considered to be part of the western Mediterranean. However, Giaccone & Sortino (1974) positioned the western-eastern boundary at the level of the Sicilian-Tunisian threshold.

Bianchi (2004), proposing the subdivision of the Italian seas into biogeographical sectors, first highlighted the need to formally consider the Strait of Messina as a singular entity, distinct from the adjacent Ionian and Tyrrhenian sub-basins. The concise motivation, referring to the peculiar richness in Pliocene Atlantic remnants highlighted by Fredj & Giaccone (1995), was subsequently integrated by Bianchi et al. (2012), who mentioned the occurrence of "local endemisms". Both indications are basically supported by the occurrence of three exclusive benthic communities, which, according to the Pérès & Picard (1964) bionomic model, were originally named "Biocénose photophile de la roche infralittorale à *Sacchoriza bulbosa* et *Phyllaria reniformis*", "Biocénose des substrats durs circalittoraux à *Laminaria ochroleuca* et *Phyllaria purpurascens*", and "Biocénose de la roche du large à *Errina aspera* et *Pachylasma giganteum*", whose presumptive distribution in the Strait of Messina has been first reported in Di Geronimo & Giacobbe (1987). Later, new field data on the distribution of the *E. aspera* assemblages (Giacobbe, 2001) showed that this "biocoenosis" along the Calabrian shelf is only found in a previously unknown site near Cape d'Armi, at the south-eastern limit of the SoM. Both hydrological and edaphic constraints are responsible of such distribution which is tied to the direct effect of the local tidal upwelling coupled with the availability of hard bottoms. The same constraints are responsible of the kelp forests distribution along a bathymetric gradient separating the shallower *S. bulbosa* from the deeper *L. ochroleuca* assemblages. Such conditions, at the present time, mostly occur along the so-called "sill", a shallower rocky bottom which extends transversally to the axis of the Strait between Punta Pezzo (Calabrian side) and Ganzirri (Sicilian side), respectively. The sill is characterized by very rough seafloors with pinnacles that rise to about 60 m from the sea surface. At the two sides of the sill the seabed features are different, due to the highest hydrodynamic levels and weak sediment supply affecting the Sicilian side, which allow the outcrop of a wide rocky substrate between approximately 100 m and 300 m depth (Selli et al., 1978; Colantoni, 1991). Until the second half of the twentieth century, shallow water kelp forests of *S. bulbosa*, now disappeared, also characterized the wave exposed hard bottoms of the S. Raineri peninsula, close to the Messina harbor (Berdar & Mojo, 1975). More in general, a dramatic kelp forest depletion has been recorded in the whole SoM area, but in recent years strong signals of recovery have been recorded (Giacobbe & Ratti, 2023) (Fig. 2).

The concentration of "typically Atlantic species" such as *S. polyschides*, *Phyllariopsis brevipes*, *Laminaria ochroleuca*, according to Fredj & Giaccone (1995), but also *Errina aspera* (with the associated ectoparasitic *Pedicularia sicula*), is the main element characterizing the SoM biota, together with the concentration of "species unique to this sector", such as *Pachylasma giganteum*. Both categories, describing the geographic confinement of some habitat forming species, contribute to strongly delineating the most striking peculiarities of the SoM benthic ecosystem, whose marked Atlantic footprint, in the Mediterranean, is exclusively shared with the far Alboran Sea.

The distribution of all these species, nevertheless, being limited to the "sill" and the closest hard bottoms, does not allow a clear delineation of the SoM effective borderlines.

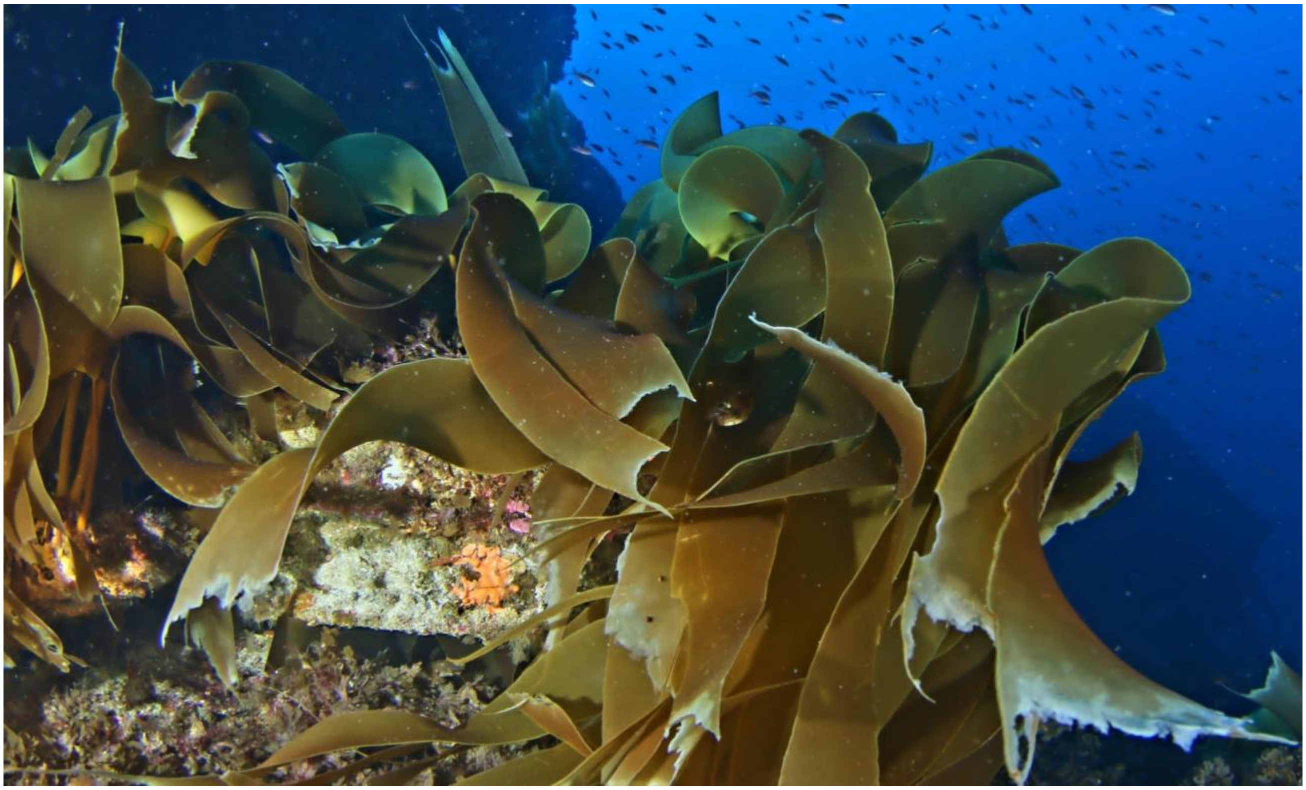

Figure 2. *Laminaria ochroleuca* kelp forest as recognized by Giacobbe & Ratti (2023), at -50 m, in Granatari (38°15′31.24″ N; 15°37′54.58″ E). Courtesy of Simona Ratti.

Flood and ebb currents, in fact, notably affecting all the SoM seafloors, produce sediment erosion, transport, and accumulation, whose effects are recognizable in the articulate mosaic of subaqueous bedforms, almost symmetrically distributed with respect to the sill. North of the sill, in fact, opens the wide axial Scilla Valley, which is characterized by rough and steep floor, at 200 m depth, rapidly passing into the smooth Palmi Basin (Selli et al., 1978; Colantoni, 1991). South to the sill, the seafloor is engraved by the head of a large and irregular depression, the Messina Valley, which in turn continues with the inner part of the Messina Canyon. In both sides of the sill, the most relevant aspect is given by the wide tidal dune fields (Longhitano, 2018), whose benthic communities are not yet reported in literature. Unpublished data (S. Giacobbe, unpublished POP'95 Report), however, suggested they might be ascribed to a deep-water depleted "coarse sands and fine gravels under bottom currents" community. Close to the dune fields, large patches of gravelly smooth bottoms show the combined effects of bioclastic deposition and silt dispersal. Peculiar to this environment are the empty shells of the gastropod *Clelandella myriamae*, found in high number in sediments from very recent to subfossil. Interestingly, despite *C. myriamae* is the most characterizing species of the taphocoenotic assemblages in this environment, it was never found alive in the SoM, and its occurrence in bioclastic seafloors is totally contrasting with the previous known muddy bathyal habitat (Giacobbe & Di Bella, 2016).

Further difficulty in defining the SoM biogeographical extent is due to the clear asymmetry affecting the Sicilian and Calabrian sides, both in physical and biological terms. Such asymmetry concerns the distribution of the *E. aspera* assemblage as well as at least another species with Atlantic affinity, the crinoid *Antedon bifida moroccana*, in its relationships with the endemic *A. mediterranea*. According to

De Domenico et al. (2009), in fact, only *A. bifida moroccana* occurs along the SoM Sicilian side and the southern part of the Calabrian side (Capo dell'Armi), tied to the directly recognizable effects of the tidal upwelling; in the remaining Calabrian coasts, which are mainly affected by the southward flowing of shallower Tyrrhenian waters, also the Mediterranean endemic *A. mediterranea* occurs. Moreover, a strict Atlantic affinity concerns also the giant clam *Panopaea glycimeris*, which exclusively occurs in a short stretch of seafloor between Cape S. Alessio (S. Giacobbe, personal observation) and Giardini Naxos (Scotti et al., 2011). This species, however, differently from the other "Atlantic remnants", which contribute to structuring peculiar species associations, apparently does not bring about any significant change or reorganization of benthic communities (S. Giacobbe, unpublished POP'95 Report).

Therefore, the SoM area cannot be identified with the geographic range of any individual species but needs to be referred to some peculiar aspects of the benthic communities determined by the local hydrodynamic regime. Examples are provided by some species that in SoM show a different bathymetric range than elsewhere in Mediterranean, such as *Corallium rubrum* and *Madrepora oculata*, which in SoM can be found in strict association (Bavestrello et al., 2023). Similarly, the black coral *Antipathella subpinnata* occurs in almost shallow waters (Fig. 3), forming mixed assemblage with gorgonian colonies both in the northern Calabrian (Bo et al., 2009) and Sicilian SoM side.

Figure 3. *Antipathella subpinnata* shallow water colonies (-45 m) in the SoM Sicilian northern side (Torre Bianca: 38°16'31.00"N, 15°38'52.18"E). Courtesy of Santi Cassisi.

High productivity of the SoM borderlines (Azzaro et al., 2007), coupled with local wind-induced up- and downwelling, responsible for the exceptionally high densities of hard bottom suspension feeders, also support rich assemblages of other soft-bottom octocorals (Porporato et al., 2008), although they are hindered by recurrent seafloor instability. By contrast, the latter condition, which is testified by diffuse gravitative deposits (Casalbore et al., 2014), is responsible for the widely occurring facies of opportunistic filter feeders, mostly the annelid *Ditrupa arietina*, whose exceptional densities in the Calabrian side are also related with the seasonal floods of intermittent rivers locally known as "fiumara" (Cosentino & Giacobbe, 2006, 2008).

Finally, some channels deeply indenting the littoral wedge (Doglioni et al., 2012; Casalbore et al., 2014) need to be mentioned. The finding of the rare amphi-Atlantic epitoniid *Opaliopsis atlantis* in the rocky outcrops of the channels (Giacobbe & Renda, 2020), in fact, suggests that this poorly investigated environment might represent a high biodiversity reservoir.

All these peculiarities, which only broadly describe the biological complexity of the SoM, reflect the effects on the biotic compartment of the peculiar seabed geomorphology and related hydrodynamic regime. The local hydrology, having tidal action as dominant forcing, generally tends to amplify the related phenomena, expanding the species bathymetric range and increasing biodiversity as well as primary and secondary production. By contrast, the same tidal regime is responsible for the absence of typical midlittoral communities (Fredj & Giaccone, 1995), due to an amphidromic system with cyclonic rotation isophase and center situated almost on the axis of the Strait (Androsov et al., 2002). Once again, therefore, the need to take the hydrodynamic regime of the SoM into strict consideration is evident. In this regard, a sketch of the SoM hydrological conditions is reported in Azzaro et al. (2004), highlighting as the characteristics of the water column quickly change in accordance with the tidal current direction, with the maximum excursions in northward currents, and mainly in the western side. Such asymmetry is also responsible for the peculiar phytoplankton distribution, whose relative scarcity in the nutrients-rich upwelled waters is explained by the unfavourable effect of the local high turbulence. By contrast, the primary productivity is high, especially in the peripheric zones, as described by Azzaro et al. (2007), who compared the Straits system to an “intermittent pump” enriching itself before providing nutrients to the close basins. These indications, which contribute to clarify some aspects of the benthic community distribution, at the same time highlight as the influence of the SM ecosystem is perceptible in adjacent basins, even at great distances.

The new formal boundaries

Thus, to provide a plausible suggestion for the SoM biogeographical boundaries, the hydrological limits must first be considered, as they were clarified by Böhm et al. (1987), referring to a peculiar water-mass which in the Strait is generated by mixing of waters of Atlantic origin and Levantine intermediate waters. According to Böhm et al. (1987), the northern edge of such water-mass extends up to 10 km from the sill, while southward it is still recognizable as a narrow coastal current flowing along the shelf of Sicily up to 100 km long. However, this flux is almost unstable, so that a better indication has been provided in the same paper in terms of the coastal water temperatures: its rapid increase south of Cape S. Alessio agrees, in our opinion, with a clear ecological cline.

The relationships between the SoM hydrological regime and the peculiar benthic assemblages, allows indeed an unambiguous definition of the SoM biogeographic boundaries. Such boundaries (Fig. 4), corresponding to more or less marked ecoclines, have as cornerstones Cape Barbi (North-eastern, Calabrian side:

38°21'13"N 15°50'00"E), Cape Rasocolmo (North-western, Sicilian side: 38°17'53"N 15°31'17"E), Cape S. Alessio (South-western, Sicilian side: 37°54'47"N 15°20'55"E), and Cape d'Armi (South-eastern, Calabrian side: 37°57'14"N 15°40'42"E). Comprised by such headlands, a complex and articulated system of diversified seafloors extends, with sinuous and not always easily recognizable limits. Such limits, due to the practical purposes of the present paper, have been strongly simplified (the northern boundary being the straight line between Cape Rasocolmo and Cape Barbi, and the southern boundary the straight line between Cape S. Alessio and Cape d'Armi), and they should be adopted as boundaries of the SoM biogeographic sector (Sector 4).

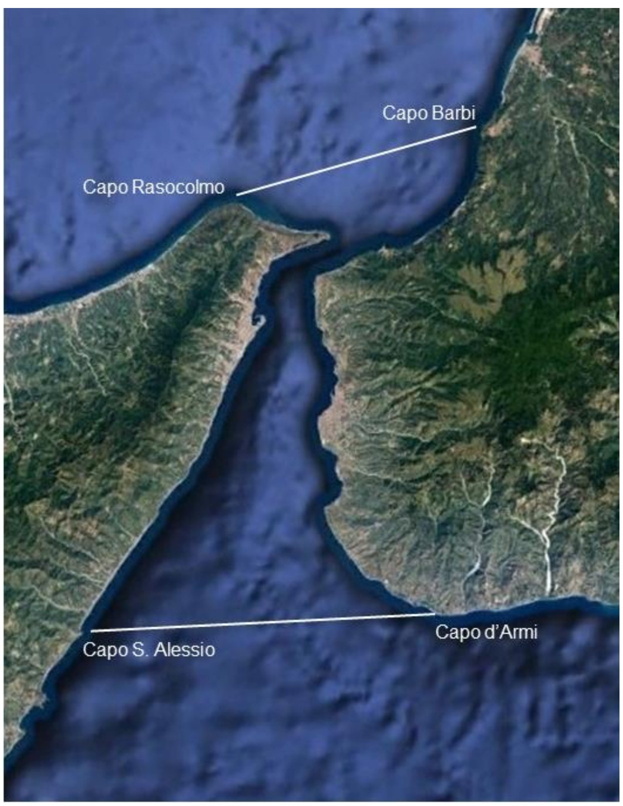

Figure 4. The new formal limits of the Sector 4: Strait of Messina.

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REFERENCES

Androsov, A. A., Kagan, B. A., Romanenkov, D. A. & Voltzinger, N. E. (2002) Numerical modelling of barotropic tidal dynamics in the strait of Messina. Advances in Water Resources, 25(4), 401–415. DOI: 10.1016/S0309-1708(02)00007-6

Azzaro, F., Decembrini, F. & Raffa, F. (2004) Hydrobiologic observations in syzygy in a latitudinal section in the Messina Straits. Rapports CIESM, 37, 483.

Azzaro, F., Decembrini, F., Raffa, F. & Crisafi, E. (2007) Seasonal variability of phytoplankton fluorescence in relation to the Straits of Messina (Sicily) tidal upwelling. Ocean Science, 3(4), 451-460. DOI: 10.5194/os-3-451-2007

Bavestrello, G., Betti, F., Canessa, M. & Bo, M. (2023) The red coral community in the Messina Strait: new findings from the 1700s Lazzaro Spallanzani collection. Diversity, 15, 177. DOI: 10.3390/d15020177

Berdar, A. & Mojo, L. (1975) Osservazioni sulla modificazione ecologica dei fondali marini a SE di S. Raineri (Stretto di Messina). Memorie di biologia marina e di oceanografia, 5(3): 57–69.

Bianchi, C.N. (2004) Proposta di suddivisione dei mari italiani in settori biogeografici. Notiziario della Società Italiana di Biologia Marina, 46, 57–59.

Bianchi, C. N. & Morri, C. (2000) Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. Marine Pollution Bulletin, 40(5), 367–376. DOI: 10.1016/S0025-326X(00)00027-8

Bianchi, C. N., Morri, C., Chiantore, M., Montefalcone, M., Parravicini, V. & Rovere, A. (2012) Mediterranean Sea biodiversity between the legacy from the past and a future of change. Chapter 1, in: Stambler, N. (ed.) Life in the Mediterranean Sea: a look at habitat changes, pp. 1-55.

Bo, M., Bavestrello, G., Canese, S., Giusti, M., Salvati, E., Angiolillo, M. & Greco, S. (2009) Characteristics of a black coral meadow in the twilight zone of the central Mediterranean Sea. Marine Ecology Progress Series, 397, 53–61. DOI: 10.3354/meps08185

Böhm, E., Magazzu, G., Wald, L. & Zoccolotti, M. L. (1987) Coastal currents on the Sicilian shelf south of Messina. Oceanologica Acta, 10(2), 137–142.

Bologna, M.A., Bonato, L., Cianferoni, F., Minelli, A., Oliverio, M., Stoch, F. & Zapparoli, M. (2022) Towards the new Checklist of the Italian fauna. Biogeographia – The Journal of Integrative Biogeography, 37, ucl001. DOI: 10.21426/B637156271

Casalbore, D., Bosman, A., Ridente, D. & Chiocci, F. L. (2014) Coastal and submarine landslides in the tectonically-active Tyrrhenian Calabrian Margin (southern Italy): examples and geohazard implications. In Submarine mass movements and their consequences: 6th international symposium (pp. 261–269). Springer International Publishing.

Colantoni, P. (1991) Seafloor morphology and sediment dynamics in the Straits of Messina. In The Straits of Messina Ecosystem. Proceedings of the Symposium held in Messina: 83–94.

Cosentino, A. & Giacobbe, S. (2006) A case study of mollusc and polychaete soft-bottom assemblages submitted to sedimentary instability in the Mediterranean Sea. Marine Ecology, 27, 170–183. DOI: 10.1111/j.1439-0485.2006.00088.x

Cosentino, A. & Giacobbe, S. (2008) Distribution and functional response of sublittoral soft-bottom assemblages to sedimentary constraints. Estuarine, Coastal and Shelf Science, 79, 263–276. DOI: 10.1016/j.ecss.2008.04.003

De Domenico, F., Giacobbe, S. & Rinelli, P. (2009) The genus *Antedon* (Crinoidea, Echinodermata) in the Strait of Messina and the nearby Tyrrhenian Sea (Cemtral Mediterranean). Italian Journal of Zoology, 76(1), 70–75. DOI: 10.1080/11250000080208860.

Di Geronimo, I. & Giacobbe, S. (1987) Cartes des biocenoses de Détroit de Messine. In: Bionomie des peuplements benthiques des substrats meubles et rocheaus plio-quaternaires du Détroit de Messine. Documents et Travaux IGAL, 11, 153–169.

Doglioni, C., Ligi, M., Scrocca, D., Bigi, S., Bortoluzzi, G., Carminati, E., Cuffaro, M., D'Oriano, F., Forleo, V., Muccini, F. & Riguzzi, F. (2012) The tectonic puzzle of the Messina area (Southern Italy): Insights from new seismic reflection data. Scientific Reports, 2, 970. DOI: 10.1038/srep00970

Flanders Marine Institute (2019) Maritime boundaries geodatabase: Maritime boundaries and exclusive economic zones (200NM), version 11. Available online at http://www.marineregions.org/. DOI: 10.14284/386

Fredj, G. & Giaccone, G. (1995) Particularités des peuplements benthiques du détroit de Messine. In: The Strait of Messina ecosystem (L. Guglielmo, A. Manganaro, E. De Domenico eds). Dipartimento di Biologia Animale ed Ecologia marina, Università di Messina, pp. 119–128.

Giaccone, G. & Sortino, M. (1974) Significato biogeografico della vegetazione marina della Sicilia e delle isole minori nell'area del Mare Mediterraneo. Bollettino di Studi ed Informazioni del Giardino coloniale di Palermo 26, 130–146.

Giacobbe, S. (2001) Distribuzione areale e batimetrica della facies a *Errina aspera* L. (Hydrozoa, Stylasteridae) nello Stretto di Messina. Biologia Marina Mediterranea, 8(1), 246–251.

Giacobbe, S. & Di Bella, A. (2016) About the wide Mediterranean distribution of the "Geographically localized" *Clelandella* *myriamae* (Gofas, 2005) (Gastropoda Trochidae). Biodiversity Journal, 7(2), 257–260.

Giacobbe, S., Renda, W. (2020) The point on *Opaliopsis atlantis* (Gastropoda: Epitoniidae) distribution: new data from the Mediterranean and implications. Papéis avulsos de Zoologia, 60, 1–7. doi.org/10.11606/1807-0205/2020.60.59.

Giacobbe, S. & Ratti, S. (2023) Unexpected recovery of *Laminaria ochroleuca* in the Strait of Messina. Marine Biodiversity, 53(4), 54. DOI: 10.1007/s12526-023-01356-x.

Longhitano, S. G. (2018). Between Scylla and Charybdis (part 1): the sedimentary dynamics of the modern Messina Strait (central Mediterranean) as analogue to interpret the past. Earth-Science Reviews, 185, 259–287. DOI: 10.1016/j.earscirev.2018.06.008

Pérès, J. M. & Picard, J. (1964) Nouveau manuel de bionomie benthique de la mer Méditerranée. Recueil des Travaux de la Station marine d'Endoume, 31(47), 1–137.

Porporato, E., Mangano, M.C., De Domenico, F., Giacobbe, S. & Spanò, N. (2008) Addensamenti di pennatulacei nello Stretto di Messina. Biologia Marina Mediterranea, 15 (1), 284–285

Relini, G. (ed.) (2008) Checklist della Flora e della Fauna dei mari italiani (I parte). Biologia Marina Mediterranea, 15 (Suppl. 1), 1–457.

Relini, G. (ed.) (2010) Checklist della Flora e della Fauna dei mari italiani (II parte). Biologia Marina Mediterranea, 17 (Suppl. 1), 1–517.

Renda, W., Amati, B., Bogi, C., Bonomolo, G., Capua, D., Dell'Angelo, B., Furfaro, G., Giannuzzi-Savelli, R., La Perna, R., Nofroni, I., Pusateri, F., Romani, L., Russo, P., Smriglio, C., Tringali, L. & Oliverio, M. (2022) The new checklist of the Italian fauna: marine Mollusca. Biogeographia – The Journal of Integrative Biogeography 37, ucl005. DOI: 10.21426/B637156028

Scotti, G., Antioco, S., Andaloro, F., & Chemello, R. (2011) Finding of a living population of *Panopea glycimeris* (Von Born, 1778) (Bivalvia; Hiatellidae) in Eastern Sicily (Mediterranean Sea). Journal of Biological Research, 15, 151.

Selli, R., Colantoni, P., Fabri, A., Rossi, S., Borsetti, A. M. & Gallignani, P. (1978) Marine geological investigations on the Messina Strait and its approaches. Giornale di Geologia, 42(2): 1–70.

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