Review

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Review

A Systematic Review of Marine Habitat Mapping in the Central-Eastern Atlantic Archipelagos: Methodologies, Current Trends, and Knowledge Gaps

Marcial Cosme De Esteban [1,*], Fernando Tuya [1], Ricardo Haroun [1] and Francisco Otero Ferrer [1,2]

[1] Biodiversity & Conservation Research Group, IU-ECOAQUA, Scientific & Technological Marine Park, 8 Universidad de Las Palmas de Gran Canaria, Crta. Taliarte s/n, 35214 Telde, Spain

[2] Department of Origins and Evolution, Muséum National d'Histoire Naturelle, MNHN, 75 rue Cuvier, Paris, France

* Correspondence: marcial.cosme@ulpgc.es; Tel.: +34 677160024

Abstract: Mapping marine habitats is fundamental for biodiversity conservation and ecosystem-based management in oceanic regions facing increasing anthropogenic and climatic pressures. Currently, with evolving Marine Spatial Planning processes in different countries, habitat mapping is a keystone element for conservation policy. This systematic review (PRISMA guidelines) examined 69 peer-reviewed studies across the Central-Eastern Atlantic archipelagos of Azores, Madeira, Canary Islands and Cabo Verde, including Mid-Atlantic Ridge sectors. We identified knowledge-gaps, methodological trends, and key challenges in habitat mapping, emphasizing the integration of cartographic, ecological, and technological perspectives. The analysis revealed a diversification of mapping methodologies; however, the lack of standardized protocols, heterogeneous datasets, and limited ground-truthing undermine the production of high-resolution bionomic maps across the region. Additionally, we found substantial regional disparities in mapping efforts, technological access, and habitat representation. Azores showed the highest taxonomic richness (393 species), dominated by acoustic surveys for deep-sea corals. Madeira advanced in remote mapping of rhodoliths and hydrozoans; studies in Canary Islands focused mainly on shallow macrophyte beds via direct observation whereas Cabo Verde remains underrepresented, with sporadic studies on corals under abiotic-stress. This review also highlights the need for harmonized frameworks, investment in technological infrastructure, and regional cooperation to improve data interoperability and modeling accuracy.

Keywords: *habitat mapping*; *coastal ecosystems*; remote sensing; rhodolith beds; macrophyte beds; corals

1. Introduction

Continental shelves provide a diverse network of habitats that support numerous species [1–3] and hold significant ecological, economic, and social values. Their importance is especially demonstrated through key ecosystem services, such as blue carbon sequestration [4–6], habitat formation [7–9], or preservation of fishing grounds and cultural activities [10–14]. These ecosystem services arise from various key habitats underpinned by "ecosystem engineers", which not only provide resources and services, but also modify local conditions by creating, maintaining, or transforming habitats [15–17]. The complexity of these habitats, related to their three-dimensionality, diversity, and arrangement of physical elements (rocks, crevices, organisms, etc.), largely determines the increased diversity and density of species [18–22]. Consequently, habitat complexity is considered decisive in the structure and function of biological communities [23,24].

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Key habitats include macrophyte beds and coral reefs [25–29]. Macrophyte beds encompass various habitats (e.g., macroalgal forests, rhodolith and seagrass seabeds), which function as submerged “forests”, offering protection and food for invertebrates and fish [30–32]. These habitats are known for their high primary production, biodiversity increases through “facilitation cascades” [14,16,33–35] and their role in carbon sequestration [3,16,17,36–38]. Particularly, rhodolith beds, consist of free-living, calcified red algae forming mobile nodules, creating unique habitats with high structural complexity over soft bare substrates. Seagrass meadows can also play a crucial role in sediment retention, juvenile fish habitat provision, and carbon fixation (e.g., blue carbon) [16,17,36]. Coral reefs, found in both shallow and deep waters [39–43], form biogenic structures that provide shelter and breeding grounds for invertebrates and fish, further enhancing biodiversity [16,17,44].

The high added value of these habitats, coupled with increasing pressures and threats, highlights the need to protect marine biodiversity while preserving essential ecosystem services [25,45–49]. Contemporary environmental management methodologies are shifting toward an ecosystem-based approach [50–53] that integrates all interactions related to the functioning of marine ecosystems -including anthropogenic- rather than addressing them in isolation [54–56]. The implementation of this marine spatial management framework requires understanding multiple factors, such as ecosystem functioning and former inter- and intraspecific interactions [57–60]. In this context, accurate data on the distribution and extent of marine habitats is essential [61–64]. Effective management and conservation strategies rely on baseline geographic information, including habitat distribution patterns, connectivity, associated biodiversity [46,65–67], and the impacts of different pressures [3,68].

Habitat mapping is a crucial first step in the sustainable management of the marine environments, a field that remains largely unexplored due to financial, logistical, and technical challenges [3,46,56]. Traditionally, habitat assessment relied on direct sampling and observations [69,70]. However, advancements in remote sensing technologies, such as acoustic, satellite, and optical methods [30,50,63,86,87], allow for the characterization of physical and biological features over large areas with reduced logistical and economic efforts [73–78]. Consequently, habitat mapping underpins essential baseline data for effective coastal management and conservation policies, though limited ecological knowledge of many marine habitats continues to hinder management effectiveness [29,59,66,69,79].

The Lusitanian biogeographical Province [80], known for its rich biodiversity, faces significant environmental pressures from climate change, tourism overdevelopment, coastal exploitation, and invasive species [81,82]. Specially, coastal economic and urban development intensifies anthropogenic pressures, as a large portion of the global population resides and/or works in these areas [83–87]. These pressures are even more pronounced in insular territories, where coastal zones constitute a substantial part of the total land area [83,88], such as the case of the Central-Eastern Atlantic volcanic archipelagos of the Azores, Madeira, Canary Islands, and Cabo Verde [44,89,90]. As insular systems, they exhibit high isolation shaping their marine biota [90,91]. These unique characteristics make them highly relevant in terms of their biogeography, ecology, evolution, and conservation biology, as they serve as natural laboratories for studying evolutionary and ecological processes [89,92,93]. However, their vulnerability underscores the importance of studying these islands to ensure their unique marine ecosystems, which requires detailed knowledge of marine habitat distribution and characteristics, highlighting the importance of advancements in seabed mapping [63,89,94–96].

This study aims to provide a comprehensive review of the current knowledge and gaps in mapping key habitats across the Central-Eastern Atlantic volcanic archipelagos. To achieve this, available methodologies mapping tools and methodologies were cataloged, their chronological use examined, and the challenges associated with their application across different habitats and depths analyzed. The review also identified knowledge gaps, such as understudied geographical areas and key habitats—both in terms of habitat type and taxonomy—highlighting regions with data scarcity that could hinder conservation efforts. Finally, recommendations were proposed to strengthen

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research initiatives and enhance the development of useful habitat mapping methodologies. In this sense, international cooperation will foster more effective decision-making processes in the framework of evolving Marine Spatial Planning activities, where marine conservation sector deserves a more intense focus.

2. Materials and Methods

This systematic review was conducted following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), to ensure transparency, reproducibility, and comprehensiveness at each stage of the process, from sourcing and selection to the analysis of the selected articles [97,98].

2.1. Study Area

The study focuses on the four volcanic archipelagos located in the Central-Eastern Atlantic Ocean: Azores, Madeira, Canary Islands, and Cabo Verde. A section of the Mid-Atlantic Ridge within the Azores exclusive economic zone (EEZ) was also considered, as it plays a crucial role in ocean current dynamics and ecological connectivity among the four archipelagos (Figure 1; [99]).

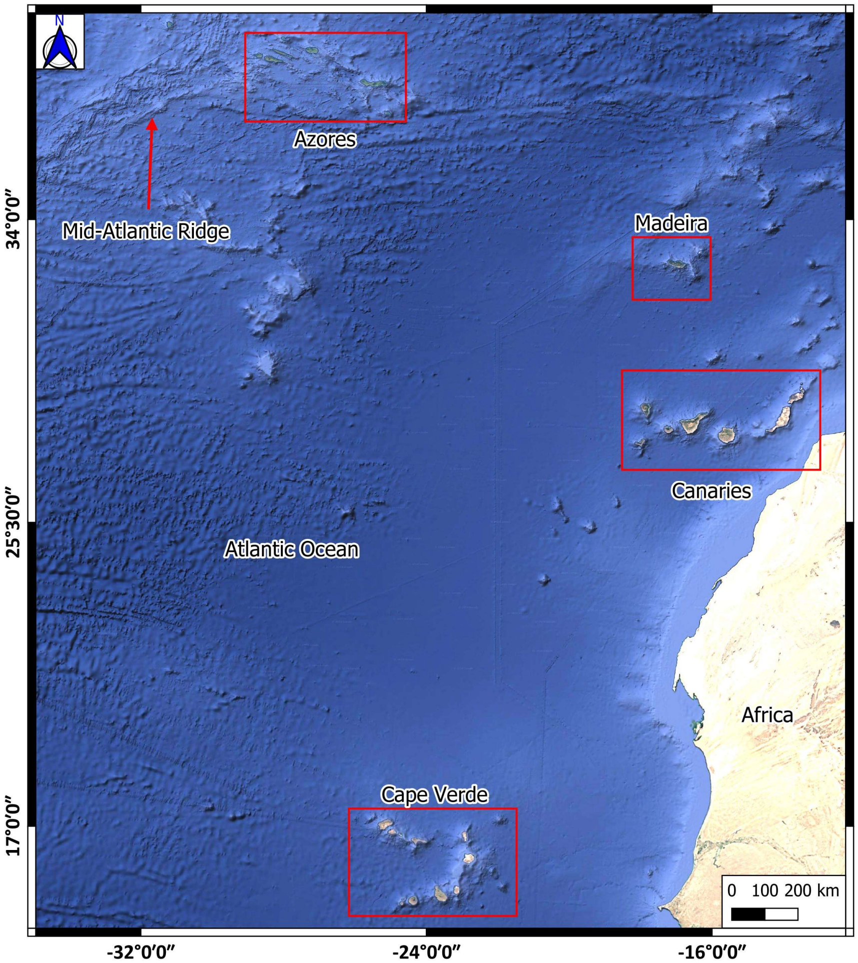

Figure 1. Location of the study area in the Central-Eastern Atlantic Ocean, showing the study areas: (a) Azores and the adjacent Mid-Atlantic Ridge, (b) Madeira archipelago, (c) Canary Islands, and (d) Cabo Verde.

The marine study area covers the so-called European Macaronesian region [100]; the term Macaronesia (composes by two Greek words: *makarion* [fortunate] and *neosi* [islands], have being used in the biogeographic literature to include the four archipelagos located in the Central-East North

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Atlantic Ocean: Azores, Madeira (including the Selvagens Isles), the Canary Islands and Cabo Verde. These oceanic archipelagos have a volcanic origin, as geological demonstrations of hotspots off Northwestern Africa with large depths found between adjacent islands. The biogeographic position of these European archipelagos encompasses a large macroclimatic gradient among them of almost 2500 km of latitudinal extension, from hyperoceanic temperate conditions in the Azores to Mediterranean to subtropical ecosystems in the case of Madeira, Selvagens, and the Canaries [101,102]. Their marine environments are mainly connected through the Canary Current, a branch of the Gulf Stream in the Eastern Atlantic moving down from the Azores through Madeira to the Canary Islands and further south to the Cape Verde Islands [103]. Recent biogeographical studies have shown a more isolated biogeographical position in the case of the Azores, whereas the marine biota of the three central archipelagos: Madeira, Selvagens and the Canary Islands showed stronger affinities among them [104,105]; as consequence, these three archipelagos defined a new biogeographical unit (= *Webbnesia*) and the marine biota of the southernmost archipelago of Cabo Verde is considered as part of the West African Transition province [106].

Aside from their common volcanic origin, these archipelagos exhibit a high degree of endemism in the terrestrial realm, underscoring their worldwide biogeographic significance [99,107], and including marked differences in both terrestrial and coastal habitats. The Azores, Madeira and Canary Islands, located at more northerly latitudes, display temperate and subtropical oceanic climates alongside rugged coastlines featuring rocky reefs that support a range of benthic communities. Their coasts range from volcanic cliffs to sandy beaches and emergent rock outcrops, which foster highly diverse marine habitats encompassing seagrass beds, macroalgal assemblages on rocky reefs and cold-water coral reefs (CWC) [99,108,109]. Conversely, Cabo Verde is situated in a dry subtropical zone, characterized by a warmer and more arid climate, where marine ecosystems are dominated by sedimentary seabeds (sandy and muddy), followed by rocky and coral reefs, and whose biota differs in composition from that of the more northerly islands [110].

2.2. Data Sources and Search Strategies

The literature collection was conducted in two primary databases, SciVerse Scopus and ISI Web of Science, with Google Scholar as a supplementary source. These platforms were selected for their extensive coverage and ability to capture relevant publications on cartography and mapping in the different oceanic archipelagos of the Central-Eastern Atlantic Ocean.

The search strategy was carefully designed and executed in December 2024. A Boolean sequence of search terms was developed, using synonyms and related terms aligned with the main objective of the study. As shown in Table 1, each column represented a set of similar terms combined using the "OR" logic, while different columns were linked using the "AND" logic. Wildcard characters (*) were applied to account for variations in term usage (e.g., "canar*" retrieves for canaries, canary, or canarias). The complete search formula is available in the supplementary material. In the Web of Science, the TS= operator was used in the search equation, while in Scopus, a similar logic was applied by adapting the TS= to TITLE-ABS-KEY=. In both, filters were applied to exclude non-relevant subject areas, such as Medicine, Arts, and Physical-Chemical-Mathematical Sciences.

Table 1. Search terms for the systematic review.

Area	Target		Habitat / Species
Macaronesia	Acoustic	Cartography	Zostera
Webbensia	Aerial	Coastal Ecosystem Services	Aquatic Vegetation
Azores	Backscatter	Conservation	Black Coral
Açores	Bathymetric	Distribution	Coral
Madeira	Drone	Geospatial Data	Eelgrass
Wild Island	GIS(1)	Habitat	Forest

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Islas Salvajes	Hydroacoustic	Habitat Connectivity	Garden
Ilhas Selvagens	Hydroacoustic Survey	Habitat Mapping	Halodule
Desertas Islands	LIDAR(2)	Imaging	Halophila
Islas Desertas	Multispectral Imaging	Map	Maerl
Canary	Radar	Mapping	MAF(5)
Canarias	Remote Sensing	Marine Environmental Assessment	Nodule
Canaries	Satellite	Marine Flora Conservation	Rhodolith
Canary Islands	Scanning	Marine Flora Mapping	Seagrass
Islas Canarias	Side Scan Sonar	Marine Habitat Protection	Seaweed
Cabo Verde	Sonar	Marine Protected Areas	
Cape Verde	Sonic	MBES	
	Sound	Monitoring	
	Spatial Mapping	MPA(4)	
	SSS(3)	Seabed Mapping	
	Telemetry	Spatial Analysis	
	Thermal Imaging	Multibeam	

(1) Geographic Information Systems; (2) Light Detection and Ranging; (3) Side Scan Sonar; (4) Marine Protected Area; (5) Marine Animal Forest.

2.3. Inclusion and Exclusion Criteria

To ensure the quality and relevance of the selected studies, rigorous "inclusion" and "exclusion" criteria were established. Studies addressing cartography and providing spatial data were included, even if explicit maps were absent. Reviews containing maps or spatial data, as well as studies focused on one or more Central-Eastern Atlantic archipelagos or the Mid-Atlantic Ridge, when linked to the concerned archipelagos, were also considered. No language or date restrictions were applied, but only peer-reviewed journal articles were included. Conversely, studies that only reported species presence/absence without spatial data, articles focused solely on methodologies without data or maps, and grey literature or non-peer-reviewed works were excluded.

2.4. Screening and Selection Process of Articles

The screening process followed the PRISMA guidelines, and it was conducted in two phases (Figure 2). First, the results were imported into Rayyan software [111], where duplicates were automatically removed and manually verified. At least two authors independently screened titles and abstracts to exclude non-relevant articles [90]. In the second phase, the preselected articles underwent a thorough review to confirm their relevance, with discrepancies resolved by a third reviewer.

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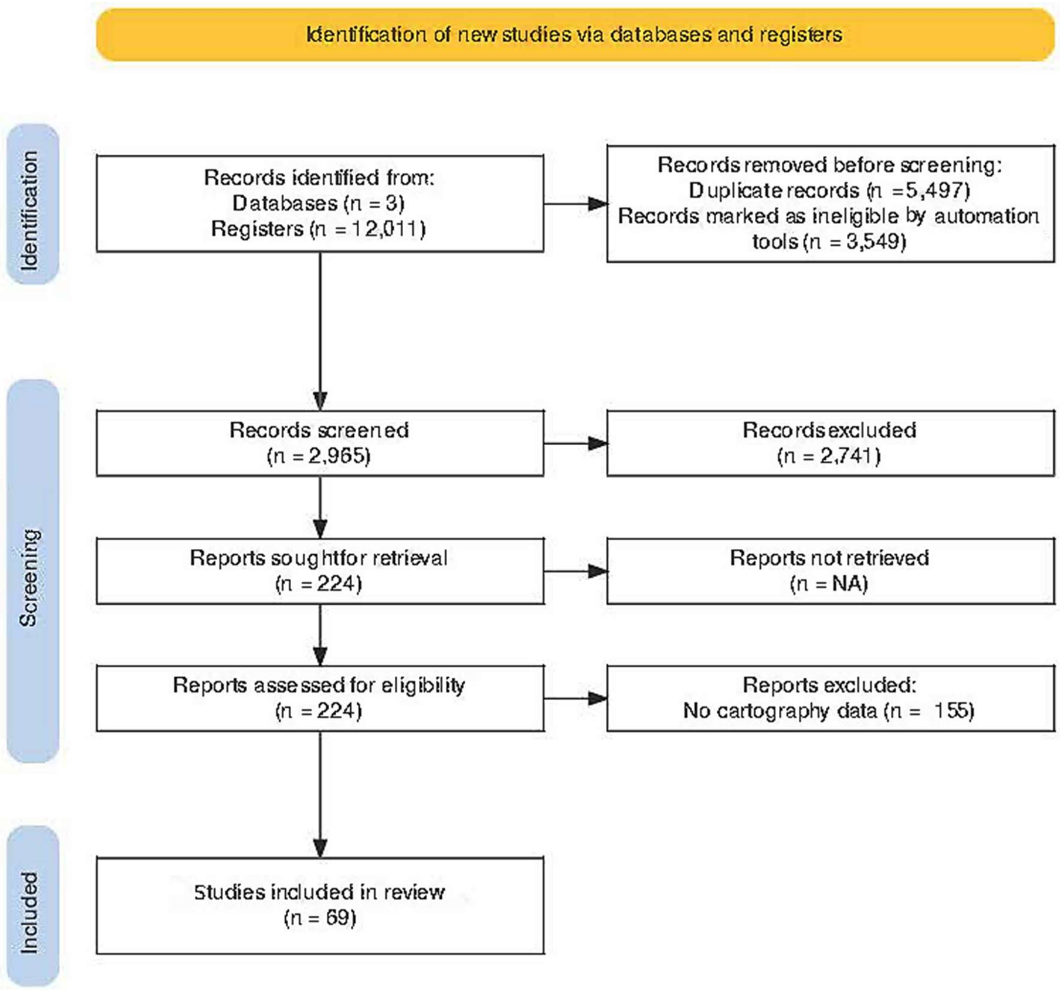

Figure 2. PRISMA flow diagram that shows the bibliography search process (created with Ryyan app [111]).

2.5. *Data Extraction and Coding*

The information from each article was first consolidated into an Excel template, creating two separate databases (Table 2): one for studies and another for species observations. The first database compiled methodological and contextual features, including mapping techniques, study area, research period, and other relevant factors. The second database focuses on taxonomic details, tracking the species recorded, the number of studies in which they appeared, and their presence or absence in each archipelago.

Table 2. Summary of data sources extracted from the literature review.

i. DATA RELATED TO STUDIES

Parameter	Option / Detail
Mapping techniques	i. Direct (SCUBA, *in-situ* observations, etc.) ii. Remote (ROVs, submersibles, etc.) iii. Aerial (drones, airborne sensors, etc.) iv. Satellite (MODIS, etc.) v. Acoustic (side scan sonar, multi-frequency sonar, etc.) vi. Sampling (dredges, corers, nets, CTD Rosette, traps etc.)

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	vii. Bibliographic studies
Study area	Archipelago id (Azores, Madeira, Canary Islands & Cabo Verde)
Year of the study	Year in which the research was conducted
Main objective	i. Exploratory (generation of original data) ii. Monitoring (tracking variables over time) iii. Mapping (mapping of habitats and distributions) iv. Bibliographic review (analysis of existing literature)
Postprocessed maps	Type (Habitat and/or geological map)
Habitat type	i. Macrophyte beds ii. Rhodolith beds iii. Coral reefs or gardens
Depth	Maximum depth range recorded
Substrate type	Hard / Soft / Mixed
Data modelling	Use of advanced statistical algorithms
Cartographic data analysis	i. Geographic Information Systems (GIS) ii. Bathymetric or acoustic analysis iii. Image analysis and computer vision iv. Statistics and modeling (including ML) v. Taxonomic or morphological approaches
Mapped zones area	Reported area (when available)

ii. Data Related to Observed Species

Parameter	Option / Detail
Taxonomy	Revised taxonomic classification in WORMS and AlgaeBase
Number of studies	i. Number of studies in which the species appears ii. Number of archipelagos in which its presence is documented
Zone	Archipelago id (Azores, Madeira, Canary Islands & Cabo Verde)

2.6. Methodological Quality Assessment and Data Analysis

Methodological quality was assessed using an ad hoc strategy that evaluated the clarity of the technique descriptions, transparency in identifying limitations, and the relevance of the methodologies employed. Three of the authors conducted the literature review, resolving any discrepancies through consensus [90].

The data analysis incorporates qualitative descriptions and graphical representations to evaluate the temporal distribution and application of mapping techniques. Statistical tools, such as SPSS [112] and PAST [113], were used for descriptive analyses and to assess correlations between different variables. Additionally, methods and patterns of habitat representation were examined to identify optimal combinations for mapping complex ecosystems. Studies with a high risk of bias were excluded to enhance the validity of the conclusions. In the graphical and tabular summaries, individual publications may be represented multiple times, as a single article can report multiple

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mapping methodologies and/or assess multiple habitat types across archipelagos. Consequently, cumulative frequencies and percentage distributions in the figures do not sum to 100%, reflecting the overlapping nature of methodological and habitat classifications rather than data omission.

3. Results

3.1. Research Effort and Objectives

From a total of 12,011 articles identified across three databases, the initial screening narrowed the sample to 2,965, of which 224 were analyzed in detail. The review focused on 69 studies, providing key insights into the mapping of marine ecosystem-engineers in the concerned archipelagos. Additionally, data on 506 species was collected and compiled into a separate database as part of the taxonomic analysis derived from the reviewed articles.

Geographical and temporal patterns revealed that 30 studies were recorded in the Canary Islands, 29 in Azores, 8 in Madeira, and 3 in Cabo Verde. Research effort has exhibited temporal and spatial variations, with differences in intensity across each archipelago (Figure 3). Azores experienced a peak in research activity between the late 1990s and early 2000s, followed by a resurgence and stabilization between 2005 and 2015, with a relative increase from 2020 onwards. In Madeira, research progressively increased starting in 2020. In the Canary Islands, research levels remained relatively constant since the early 2010s, with more intense activity peaks observed from 2020 onwards, persisting to the present day. Finally, in Cabo Verde, all recorded studies were conducted between 2023 and 2024. Regarding the study objectives, 41% (28 studies) focused on mapping, 38% (26 studies) on explorations, and 21% (15 studies) on monitoring (Table A1).

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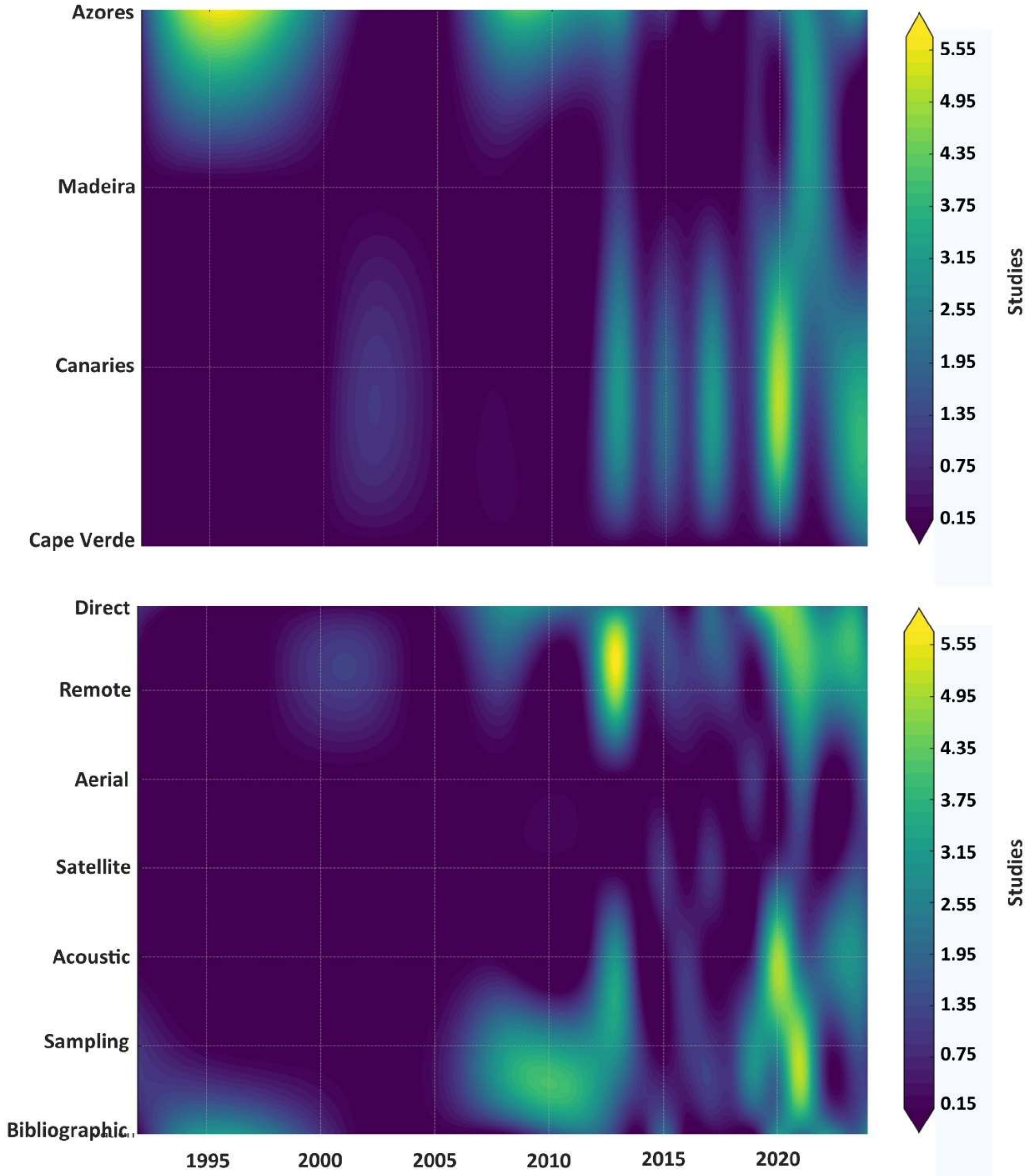

Figure 3. Temporal changes in the number of studies by region (top) and by type of sampling method (bottom) in the context of marine research in Central-Eastern Atlantic archipelagos. The color intensity represents the density of surveys over time (1990-2025), with higher values in yellow and lower values in purple.

3.2. Methodologies and Habitats Analysis

The analyzed studies covered three main types of marine habitats: macrophyte beds, rhodolith beds, and coral reefs. Various methodologies were employed, including direct, remote, acoustic, satellite and/or aerial observation, sampling, and bibliographic review.

The methodologies have exhibit different usage patterns over time (Figure 3). Direct observation has been documented since the beginning, with higher recurrence during 2020 and 2021. Remote observation first appeared in 2000 and showed notable occurrences in 2013 and 2021. Aerial methodologies emerged in 2019, with additional occurrences in 2021 and 2024. Satellite observation first appeared in 2015 and was documented in isolated studies until 2024. Acoustics was not reported until 2012 and became more prevalent from 2020 onwards. Sampling has been used intermittently

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since 1992, with increased application during the 2010s. Finally, bibliographic reviews were initially recorded in the early 2000s and reappeared consistently from 2020 to 2024.

Comparative analysis among (Figure 4) and within (Figure 5) archipelagos revealed similar variations in the application of observation and data collection methodologies. In Azores, remote observation was the predominant method, followed to a lesser extent by direct observation and sampling, with similar usage. Acoustic methods, aerial techniques, and bibliographic review were employed less frequently. In contrast, although all methodologies—except remote observation—were relatively more common in the Canary Islands, direct observation emerged as the primary method, complemented by sampling. The use of the remaining methodologies (remote observation, acoustic methods, and bibliographic review) was identical, whereas satellite observation was incorporated in a moderate and exclusive manner in the Canary Islands. In Madeira, direct observation, acoustic methods, and sampling constituted the most employed techniques, whereas remote sensing, aerial observation, and bibliographic review were applied to a lesser extent. The index of aerial observation usage was similar to that used in Canary Islands and Azores. Finally, in Cabo Verde, the only methodologies implemented were remote observation—which proved to be the most used—followed by direct observation and acoustic methods, with equivalent usage. Bibliographic review was the only additional methodology recorded in all studies conducted in Cabo Verde.

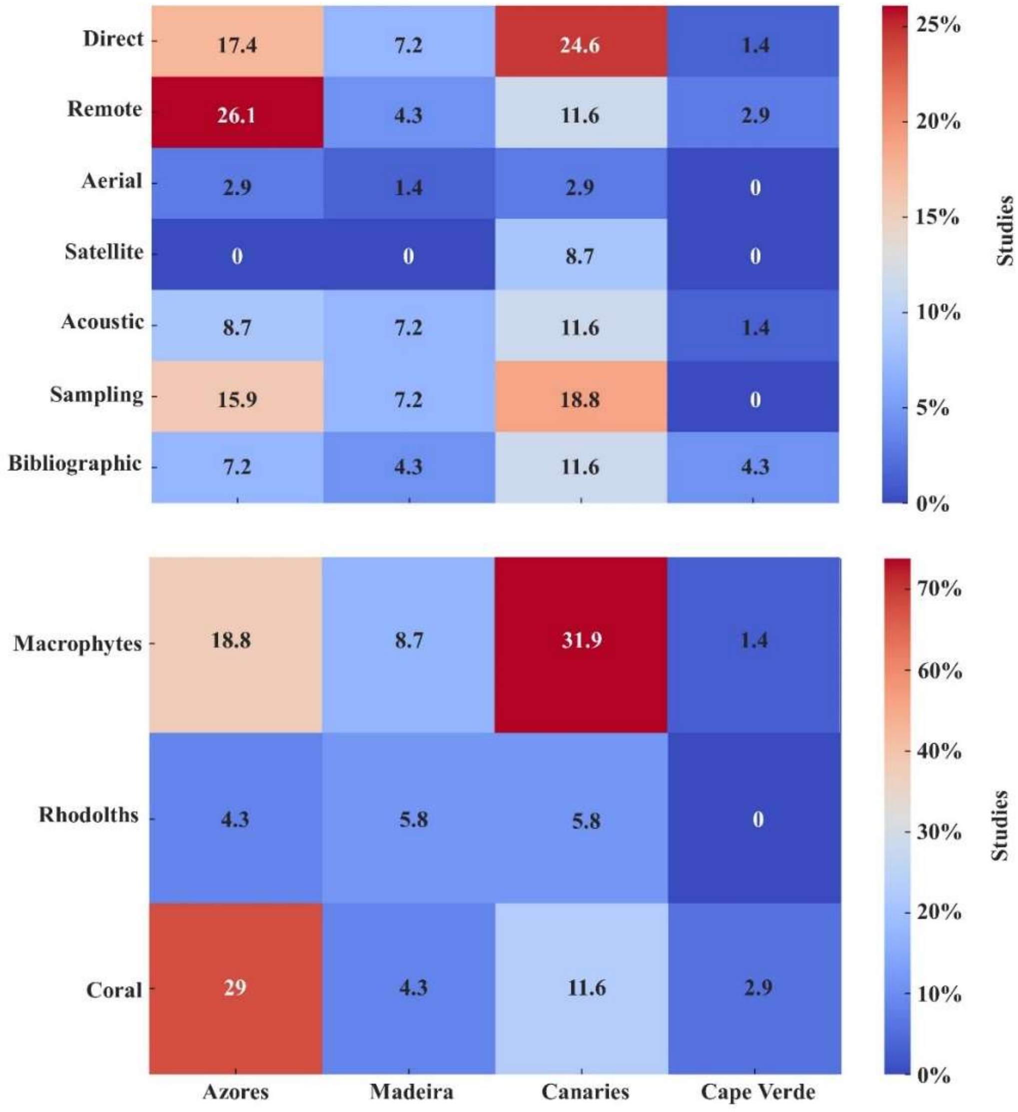

Figure 4. Interregional differences in terms of (top) the types of sampling methods used and (bottom) the habitats analyzed. Individual studies may be counted in multiple categories (methodologies and/or habitats), so cumulative percentages do not sum to 100%.

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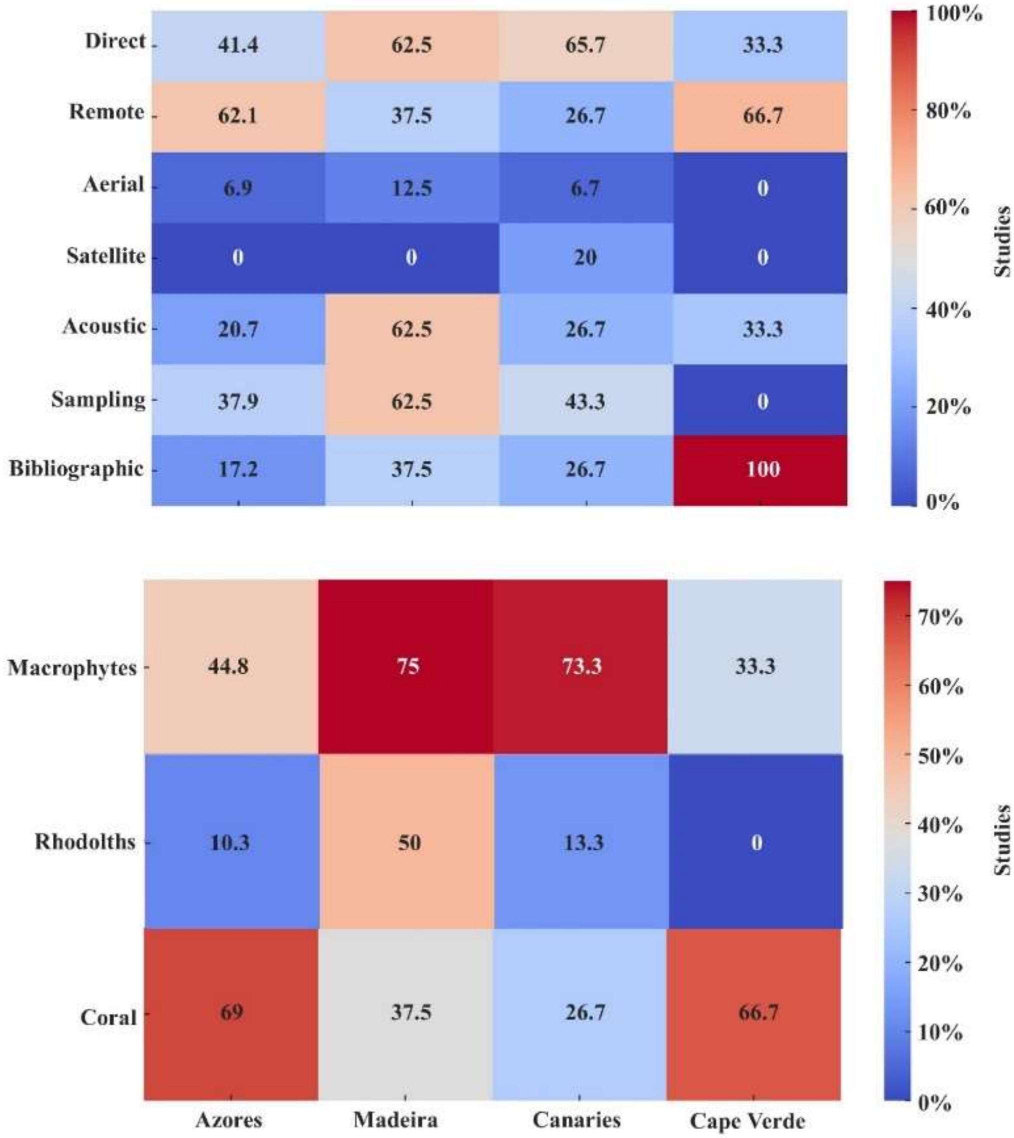

Figure 5. Intraregional differences in (top) the types of sampling methods used and (bottom) the habitats analyzed. Individual studies may be counted in multiple categories (methodologies and/or habitats), so cumulative percentages do not sum to 100%.

3.3. Biodiversity Analysis

The greatest research effort was carried out on macroalgal beds (42 studies), followed by coral reefs (33 studies) and, to a lesser extent, by rhodolith beds (11 studies). Similarly, habitats comparisons revealed differences in the research efforts on these habitats among (Figure 4) and within (Figure 5) the archipelagos, where Azores exhibited the higher percentage of studies related to coral reefs. Conversely, the Canary Islands focused its research efforts toward macroalgal beds, followed by Azores and Madeira. Rhodolith beds had a similar percentage of studies across all the archipelagos, except for Cabo Verde, where no studies targeting this habitat were observed.

Our literature review recorded a total of 505 species, with the highest diversity observed in the Azores (393 species), followed by the Canary Islands (131), Madeira (69), and Cabo Verde (10) (Figure 6, 7; Table A1). The Azores concentrated the highest percentage of cnidarian species, exhibiting a similar diversity in both Hexacorallia and Octocorallia classes, accounting for ca. 86.4% of the

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cnidarian species observed. In particular, the Mid-Atlantic Ridge predominantly documented cnidarians (ca. 99%: Table A1). Likewise, the Azores included the greatest diversity of marine plants (Figure 7; Table A2), with the exception of Tracheophyta, which were not represented. Rhodophyta were predominant, followed by Chlorophyta and a similar percentage of Ochrophyta (Figure 7; Table A2). In the other archipelagos, a similar pattern was observed regarding cnidarians and macroalgae. However, Madeira documented a similarity in the diversity of cnidarians between Hexacorallia and Hydrozoa, presenting a lower representation of Octocorallia and a slight representation of Tracheophyta. The Canary Islands exhibited the highest diversity of Tracheophyta (Figure 7; Table A2). With respect to cnidarians in the Canary Islands, a higher percentage of Hexacorallia was observed, followed by Octocorallia and Hydrozoa. Finally, in Cabo Verde, the diversity was concentrated in cnidarians, with a greater diversity of Octocorallia than of Hexacorallia, and no macroalgae were documented, except for Tracheophyta (Figure 7; Table A2).

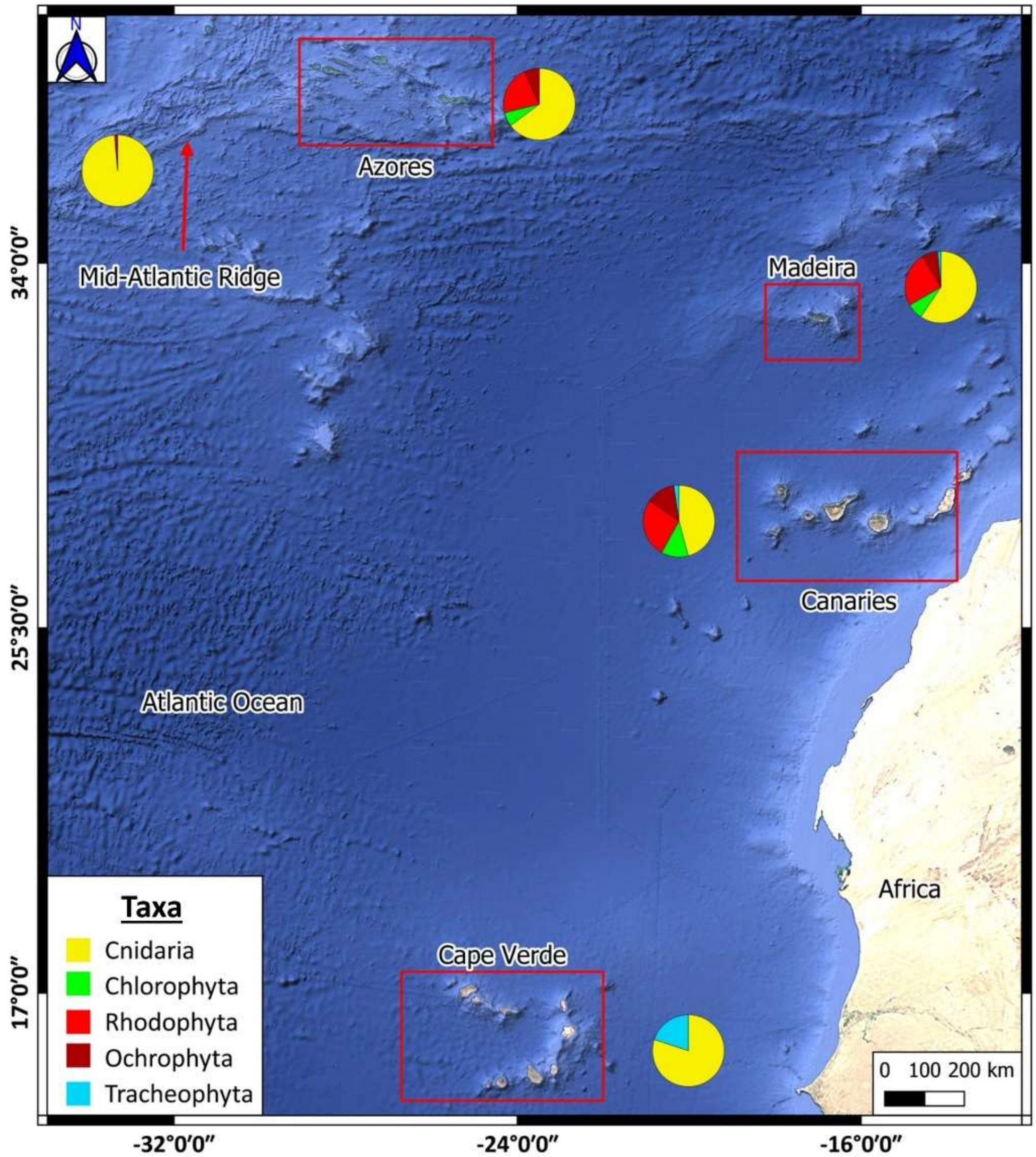

Figure 6. Spatial distribution of the study regions in Central-Eastern Atlantic archipelagos and the Mid-Atlantic Ridge, with proportional representation of the main taxonomic categories registered in each region.

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Figure 7. Species richness by taxonomic category and region in the Central-Eastern Atlantic archipelagos and the Mid-Atlantic Ridge. The matrix shows the number of species recorded per group.

Regarding to singular species (Table A2), it was evidenced that the greatest research effort was focused on seagrass meadows, specifically on *Cymodocea nodosa* (Ucria) Ascherson, 1870, which was the subject of 14 studies. Subsequently, the effort was directed toward brown macroalgae, in particular *Dictyota spp* (J.V. Lamouroux, 1809) and *Padina pavonica* (Linnaeus, Thivy, 1960), which were the subject of 12 and 10 studies, respectively. Among corals, the species that were studied most intensively were the octocoral *Viminella flagellum* (Johnson, 1863) and two hexacorals, *Desmophyllum pertusum* (Linnaeus, 1758) and *Antipathella wollastoni* (Gray, 1857), each appearing in 8 studies.

Methodological approaches to studying marine benthic communities varied according to habitat and region (Figure 8). Throughout the geographical range considered, macroalgae were studied mainly by direct observation and sampling, while remote sensing and acoustic methods were used less frequently. In rhodolith beds, direct observation (7 cases) and acoustic methods (5 cases) were the most common approaches. Corals, which were found at depths of up to 4,000 m, were investigated primarily by remote sensing (25 cases) and acoustic methods (13 cases), although sampling and direct observation were also applied. Acoustic methodologies, in particular, were used more frequently in the Canary Islands (8 cases) and Azores (6 cases). Overall, the Azores and the Canary Islands represented the majority of the studies, demonstrating a diverse methodological approach.

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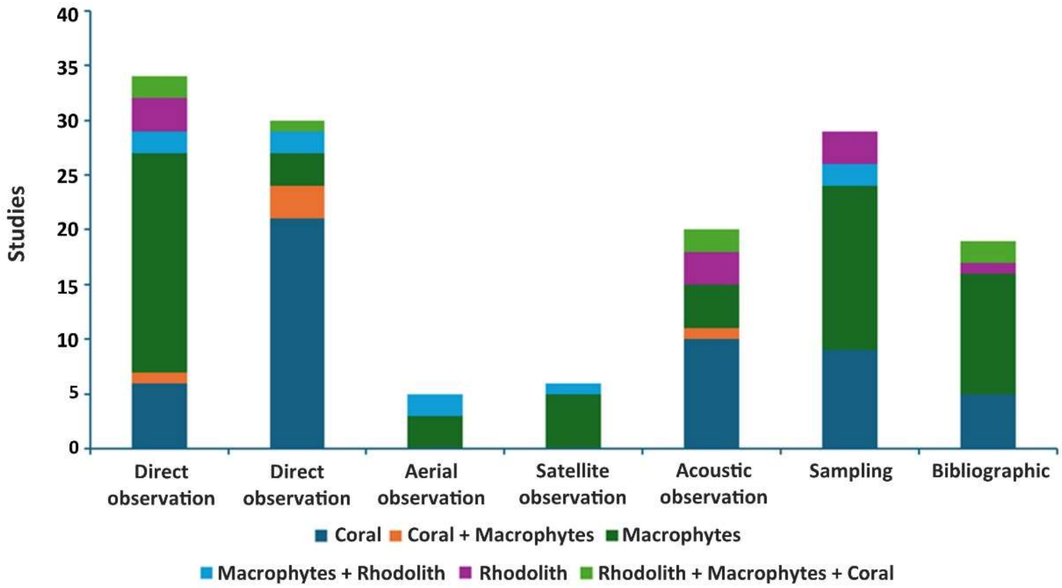

Figure 8. Number of studies by type of sampling method, broken down according to the combination of areas and habitats analyzed.

3.4. Postprocessing Data Analyses

Of the total studies analyzed, 62% incorporated some form of mapping, with 25% generating geological cartography. The remaining studies provided cartographic data as coverage or visual percentages, supplementing spatial analyses. Computational modeling appeared in ca. 49% of the studies, showing a ca. 750% increase between 2010 and 2020, followed by an additional 100% rise between 2020 and 2024 (Table A1).

This growth coincided with the integration of Geographic Information Systems (GIS), described in ca. 47% of the studies, combined often with image analysis tools (18 studies) or remote sensing data (15 studies). GIS was primarily used to predict coral and macrophyte beds distributions based on remote, acoustic, and direct observation data (Figure 9).

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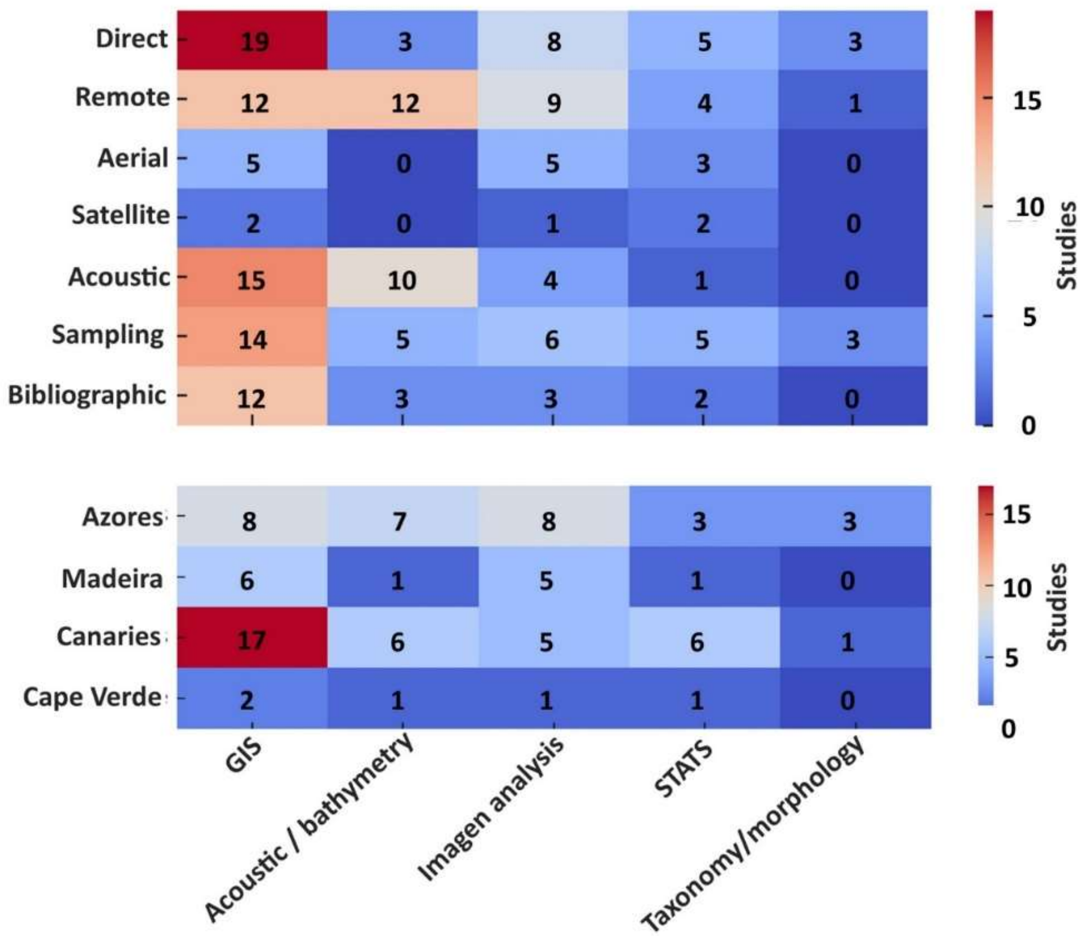

Figure 9. List of post-processing analyses, including Geographic Information Systems (GIS), acoustic data analysis, image analysis, statistical analysis (STATS) and taxonomic/morphological analysis, with: (top) the types of sampling methods used; and (bottom) the archipelagos analyzed.

The Azores and Canary Islands showed a strong preference for GIS, while Madeira relied more on taxonomic and morphological tools. Rhodolith beds were linked to GIS and acoustic/bathymetric analysis, macrophytes to GIS and statistical analysis, and corals to GIS and image analysis (Figure 9).

4. Discussion

Although marine research in some of the Central-Eastern Atlantic archipelagos dates back to the 19th century, these studies have predominantly focused on taxonomy and species cataloguing, relegating habitat mapping to a secondary position [114]. During the last 30 years, research efforts have been concentrated, particularly in the Azores and the Canary Islands archipelagos, while in Cabo Verde, such efforts are scarce or nearly non-existent (Figure 10).

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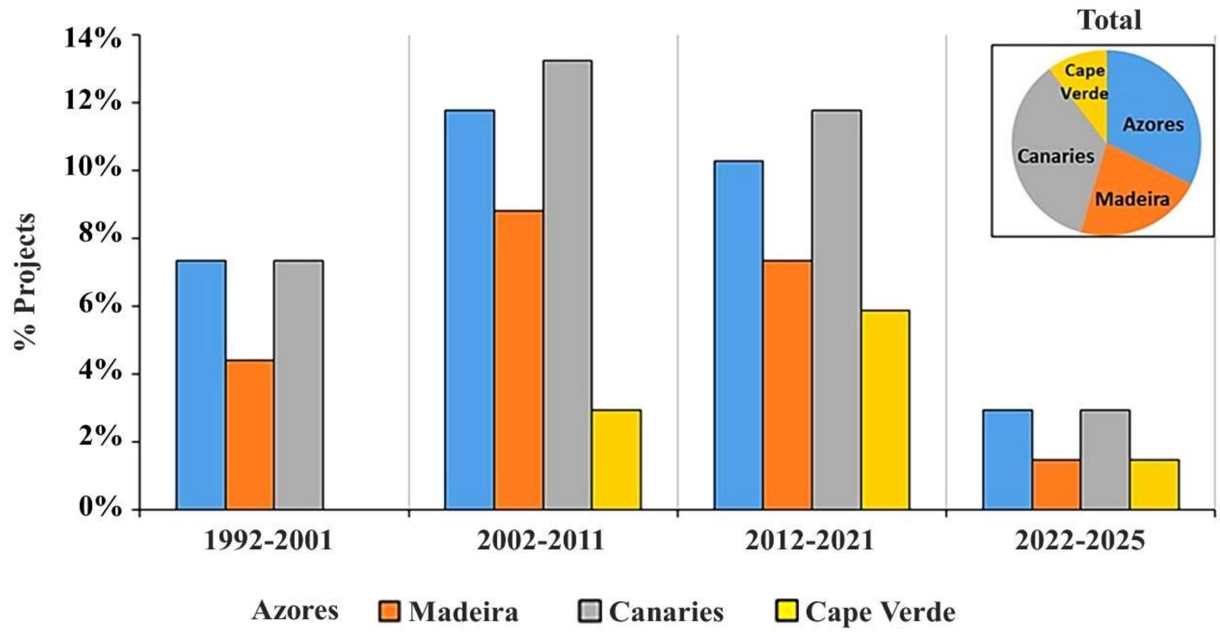

Figure 10. Percentage of European-funded projects by Archipelago. Sources: https://cinea.ec.europa.eu/programmes/life_en; https://cordis.europa.eu/; https://interreg.eu/; https://fundacion-biodiversidad.es/; https://www.biodiversa.eu/; https://plocan.eu/; https://www.mac-interreg.org/.

Transnational cooperation projects focus on monitoring, conservation, cataloguing, and mapping of marine biotopes dominated by habitat-forming megafauna, considered Vulnerable Marine Ecosystems (VMEs), through projects such as MISTICSEAS, MIMAR, POPCORN, and MOVE ON (https:misticseas3.com/es; https:www.mare-centre.pt/en/proj/mimar; https:ww.ecoaqua.eu/es/habitats-popcorn.html; https://www.moveon-project.eu /homepage/). However, updated information on the current progress in comprehensive seabed mapping remains limited, a situation comparable to studies conducted on the Mid-Atlantic Ridge, where much accumulated knowledge from multiple multinational expeditions since 1954 remains unpublished in indexed scientific journals, primarily existing as technical reports or grey literature [115,116].

4.1. Methodologies and Technological Advances

4.1.1. . Direct and Remote Observation Techniques

The most cost-effective methodology for characterizing marine habitats is direct observation, generally complemented by in situ sampling, as it provides detailed descriptions and generates thematic maps based on biota distribution, facilitating the identification of spatial patterns and ecological processes [96,117–120].

Although direct observation of keystone species and habitats has been systematically employed over time, it is now complemented by emerging remote technologies, such as optical remote observation, or its combination with acoustic and satellite methods, enabling three-dimensional analysis (horizontal and vertical dimensions) [96,121,122]. Currently, marine habitats can be effectively mapped using various stationery and mobile cameras, including remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs), providing high-resolution imagery for species identification with expert analysis [123,124]. These tools can explore challenging areas, enabling long-term monitoring and broad data collection [125–128]. However, they face limitations in covering very extensive areas and dealing with the "canopy effect," which obscures deeper layers, necessitating complementary mapping methods [120,129]. Specifically, in the Canary Islands, camera-based methods — either standalone or combined with other methods — has proven particularly effective for subtidal habitats and deep-water ecological studies, more so than for intertidal zones [120,130]. Furthermore, this approach aligns well with other methodologies, such as the MNCR biotope method employed in the Azores, facilitating the identification and monitoring of structural changes within algal communities [131].

4.1.2. Acoustic Methodologies

Technological advancements have transformed the way information is acquired and interpreted [132,133]. The development of acoustic technology in the 1940s revolutionized seabed exploration, enabling the interpretation of seabed textures over extensive areas and the creation of more realistic images [134,135]. Over time, technological improvements have significantly enhanced data acquisition and image resolution by refining acoustic signal properties and advancing digital tools for acoustic data analysis [135,136]. Among the various acoustic systems, wide-beam or multibeam systems (Side-Scan Sonar or SSS) [134,135,137], single-beam echo sounders or fish-finders [135,138], and multibeam bathymetric systems (MBES) [135,139] are widely utilized. Within the concerned oceanic archipelagos, this review highlighted SSS and MBES as the most versatile acoustic technologies employed by regional marine research, particularly for habitat characterization along the Mid-Atlantic Ridge [14,56,140,141].

Our review suggests that SSS was particularly effective in identifying substrate textures, highly efficient in habitats with sedimentary and rocky bottoms, as well as detecting coral reefs and seagrass beds in the Azores and Canary Islands [14,141,142]. Conversely, MBES was more precise in measuring bathymetry and seabed relief, making it more suitable for characterizing deep-water habitats, such as coral reefs along the Mid-Atlantic Ridge [56,143–145]. Furthermore, advancements in MBES post-processing have facilitated the implementation of new Multi-Detection (MD) techniques capable of estimating the presence of CWC gardens in the Azores and Canary Islands (e.g., black corals, [46,56,146], undetectable directly via SSS or MBES due to their proteinaceous composition. Such techniques lay the groundwork for enhancing future distribution maps of other key habitats [146].

4.1.3. Aerial and Satellite Methodologies

Aerial remote sensing is transforming marine mapping by providing high-resolution data on habitat coverage and coastal morphological changes using optical, thermal, and hyperspectral sensors [147]. Its capacity for operating at high spatial resolution makes it ideal for monitoring coastal ecosystems and intertidal zones, facilitating vegetation cover analysis [4,147–150]. Aerial platforms equipped with LIDAR (Light Detection and Ranging) enable precise bathymetric mapping in shallow waters [96], generating detailed digital models of sandy bottoms and reefs [4,148–151]. Specifically, in the Azores, Madeira and the Canary Islands, drones (Unmanned Aircraft Systems or UAS) have effectively monitored shallow waters and algal blooms; however, highly heterogeneous habitats present methodological challenges due to environmental and meteorological variables limiting their spatio-temporal applicability [149–151]. Additionally, they cannot accurately differentiate benthic communities without ground-truthing support [149,150]. To overcome these limitations, Monteiro et al. (2021) proposes an integrated approach, by combining in situ data— specific benthic composition —with physiographic mapping derived from UAS imagery.

Satellite platforms (Sentinel, Landsat, WorldView) employ multispectral and hyperspectral sensors, enabling large-scale monitoring of shallow marine ecosystems [152–158]. They offer extensive temporal and spatial coverage, providing characterizable images alongside abiotic and oceanographic variables such as temperature, pH, or chlorophyll [147,159–165]. Despite their effectiveness in marine habitat mapping, satellite studies have been conducted almost exclusively in the Canary Islands, frequently adopting a single-methodological approach and facing limitations due to reliance on reflectance and/or spectral profiles without integrating in situ biological data [149,164]. For example, multitemporal satellite image analysis was applied to evaluate the impact of the Granadilla port construction on the Special Conservation Area (ZEC) of “Sebadales del Sur” in

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Tenerife (Canary Islands) [166]. Cosme De Esteban et al. (2023) underscored the importance of ground-truthing regarding satellite approach, as for example comparisons carried out in Príncipe Island (Gulf of Guinea) that revealed discrepancies in delineating marine habitats of high ecological value, such as rhodolith beds, where the acoustic methodology supported by direct observations was more precise compared to satellite methods. Furthermore, Eugenio et al. (2023) highlights the efficacy of these multitemporal approaches integrating bathymetric and benthic studies to detect variations through qualitative and quantitative analysis, producing high-resolution maps.

Globally, aerial methods provide higher spatial resolution and greater flexibility for selecting optimal environmental conditions, whereas satellite imagery analysis reduces exploratory sampling needs, improving efficiency in time, cost, and reducing sampling bias [149–151]. Despite proven efficacy, aerial and satellite remote sensing methodologies remain underrepresented, predominantly applied in the Canary Islands and the Azores, where usage has increased since 2021. In the Canary Islands, image processing and automatic classification algorithms based on artificial intelligence and deep learning have achieved up to ca. 96% effectiveness in discriminating species, such as the genera *Cymodocea and Gongolaria* [151], highlighting the increased analytical precision made possible by these advancements; however, clearly defined training areas and ground-truthing validation remain essential [160,164,167].

4.1.4. Data Postprocessing

Once cartographic data is collected, integrating them into a unified reference framework becomes essential. This integration is facilitated by geographic information systems (GIS), which aid in spatial organization and analysis [168–170]. GIS effectively consolidate datasets that differ in spatial, temporal, and thematic scales, thereby addressing informational heterogeneity [171,172]. Literature demonstrates extensive use of specialized software for image analysis [114,120] and GIS programs (e.g., ESRI's ArcGIS or QGIS) for the integration of georeferenced vector and raster data [4,115,148,173]. Additionally, analytical interfaces have been optimized through additional tools that facilitate visualization and map overlays, allowing the combination of habitat information and physicochemical variables. Such integration is pivotal for conducting statistical analyses and creating predictive maps through modeling [141,142].

Following database integration, habitat mapping advances by modeling habitat conditions, emphasizing the biological integrity index and anthropogenic stress factors [72,174].

Identifying new biotopes and extensive data collection on taxonomic diversity significantly enhances predictive statistical modeling at multiple spatial scales [175,176]. This modeling facilitates an integrated assessment of biodiversity and generates predictive maps incorporating anthropogenic risks and impacts [177–180]. According to Braga-Henriques et al. (2013), accurate modeling and data analysis require standardized data formats. However, heterogenous data collection from different periods, campaigns, and multinational organizations complicates direct standardization, requiring the use of probability mapping or prior data refinement according to established standards [114]. Refinement involves standardizing classifications and terminologies to ensure coherent mapping and effective environmental data storage [114]. Consequently, the hierarchical EUNIS habitat classification system, extensively applied across Europe, can support large-scale habitat mapping by integrating comprehensive ecological knowledge and spatial data on seabed characteristics [166]. Accordingly, in the Canary Islands, a study provided the first comprehensive spatial assessment of benthic ecosystem service supply (until 50 m depth; [181]), generating maps through a flexible, updatable methodological approach based on scientific literature, directly applicable to marine spatial planning.

One of the initial steps in Mapping and Assessment of Ecosystems and their Services (MAES) involves ecological niche and food web characterization using specialized models and software (e.g., ECOPATH, ECOSIM, ENFA, or MAXENT). These tools are crucial for analyzing energy flows and predicting species distribution changes due to environmental disturbances and anthropogenic activities [96,147]. Their application has been pivotal in predictive analyses of species distribution, such as CWC, in studies conducted in the Azores and Cabo Verde [176,182]. When information is limited or historically incomplete, implementing ensemble models has proven effective. In Cabo Verde and the Canary Islands, combining these models with AI and deep learning classification techniques, predicted (i) new CWC presence areas on seamounts [182], (ii) identified the potential distribution of algae (both essential and invasive), and (iii) assessed seagrass meadow conditions following port infrastructure construction [130,183]. In the Azores, integrating data on anthropogenic activities (e.g., fisheries) and protected areas has facilitated evaluations of interactions between key habitats, such as macroalgae and CWC, and resources [129,142,176]. This information provides critical insights into ecosystem functioning, niche interactions and influencing variables, contributing to the development of distribution maps that inform spatial planning and conservation strategies of these essential habitats [4,142,162,176]. Finally, in the Canary Islands, visual analyses and the first ecological model of an MPA have demonstrated the potential of this conservation tool and the responses of communities to natural events [162,184], thereby facilitating adjustments in MPA design and management policies. Collectively, these data support improvements in design and management policies to ensure the conservation and recovery of ecosystems [4,162,184].

4.2. Habitat Mapping

Marine habitat maps are developed using a variety of methodologies that integrate multiple sources of data (see section 4.1). Biological data (e.g., species and community distributions), geophysical variables (e.g., bathymetry, geomorphology, physicochemical parameters), and habitat-related factors (e.g., ecosystem services and local and global threats) collectively determine the precision, spatial coverage, quality, and overall utility of the final habitat map.

4.2.1. Methodologies

Marine habitat mapping remains operationally challenging and costly despite technological advancements since the late 1990s, which have enhanced spatial coverage and data accuracy [114,185]. While studies often rely on either direct imaging or remote observation methods individually [149,186], integrating multiple methodologies significantly enhance accuracy by offsetting each technique's inherent limitations [120]. For instance, in the Canary Islands and Azores, studies relying exclusively on remote sensing techniques effectively describe facies and community structure. However, these approaches can be limited by the "canopy effect", where dense algae cover or CWC gardens may obscure underlying strata, hindering the observation of all present taxa [120]. Furthermore, although most benthic areas provide valuable data, not all provide sufficient information to produce comprehensive habitat mapping. Therefore, it is essential to clearly define the types of thematic maps that can be generated from such data [31,144]. No single approach exists for their development, given the multidisciplinary complexity and the variability associated with the specific objectives of each project. Consequently, multidisciplinary campaigns are conducted—such as the one carried out in the Azores by Somoza et al. (2020)—in which both biological and abiotic data (e.g., geophysical, hydrographic, geological, oceanographic, etc.) were collected, enabling the description of new hard and soft coral gardens and the analysis of the factors that determined their location and distribution.

4.2.2. Biotic-Abiotic Data

Marine habitat maps integrate multiple data sources, including biological (e.g., species and community distributions) and geophysical variables (e.g., bathymetry, geomorphology and physicochemical parameters). According to Brown et al. (2011), habitat maps can be classified based on mapped variables, distinguishing between biological and abiotic data [45,187,188]. Adopting a hierarchical, multiscale approach at species, community, and ecoregion levels enhances maps comprehensiveness [123,189,190]. Additionally, discovering new biotopes and detecting structural or distributional changes through repeat mapping or predictive modelling improve habitat-

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classification accuracy [149,162,167,183]. However, maps focused solely on geophysical features remain incomplete without integrating biological information [169,191–193]. In these volcanic archipelagos, geological studies commonly regard biological analyses as secondary, especially in deep-water habitats such as the Mid-Atlantic Ridge and hydrothermal areas of the Azores [141,143,185,194]. Since 2013, however, multidisciplinary research —particularly in the Azores and the Canary Islands— has significantly expanded, driven by technological innovations, advanced methodologies, integrated management plans, and improved infrastructure and funding availability (Figure 10; [178]).

Other mapping investigations treat spatial information as complementary or secondary to the primary objective, which is to collect biotic or abiotic data from marine habitats or facies. For example, research on hydrothermal habitats, in metal-rich areas—such as those hosting *Rimicaris* shrimp populations along the Mid-Atlantic Ridge (Azores)—enable the generation of more accurate predictive models for species distributions [186]. Conversely, investigations that specifically map and characterize valuable habitats, such as the seagrass meadows of *C. nodosa* in the Canary Islands, facilitate the prediction of dynamics in related communities, including fishery populations [164,195].

4.2.3. Habitat-Related Factors

Marine habitats are increasingly threatened by global and local threats (e.g., climate change, overfishing, pollution and coastal development), underscoring the need for up-to-date habitat mapping to manage these ecosystems effectively [149]. In the concerned oceanic archipelagos, several studies have already used direct and remote-sensing techniques to detect and map local threats (e.g., marine litter, trawling, long line fisheries, etc.), showing how cumulative stressors erode functional diversity and community structure over time, particularly in morphologically complex taxa such as CWC [136,140,185,196]. Additionally, marine litter data has been used in advanced predictive modelling to pinpoint plastic accumulation hotspots and compare them with potential key habitat areas [197]. Documenting spatial links between habitats and both historical and contemporary local threats is therefore essential for evidence-based conservation and management [116,130,148,164]. Thus, Martín-García et al. (2022) established cause and effect relationships between human and environmental drivers that influence the distribution of brown macroalgae (e.g., *Gongolaria abies-marina*) in the western Canary waters. Equally, studies performed in Cabo Verde on abiotic factors (e.g., topography and hydrodynamics) are essential for characterizing habitats and supporting predictive models. This approach has effectively identified food supply mechanisms for suspension feeders and potential areas for key species such as the coral *Enallopsammia rostrata* [184].

Understanding how the distribution and persistence of key habitats have changed in response to local threats is also critical for contextualizing recent observations. In Madeira, a southward regression of *Laminaria ochroleuca* has been documented [140], along with a decline in several Sargassaceae species [130]. Nonetheless, high resolution imagery of adult *L. ochroleuca* specimens (ca. 5–7 years) suggests that the archipelago may serve as a climate refuge against ocean warming [140]. Meanwhile, the first exhaustive mapping of rhodolith beds in Madeira revealed a widespread distribution across the archipelago, extending to depths of ~100 m—considerably deeper than those typically reported in the northeastern Atlantic—and comparable to the Azores [175]. Finally, regarding seagrass beds, *Cymodocea nodosa* and *Avrainvillea canariensis* patches have decreased in southern areas within a Marine Protected Area (Parque Natural Marino de Cabo Girão) [114,173,198]. In the Azores, regressions have also been observed in several species of the Sargassaceae family [130]. However, while the mesophotic niche occupied by algae in the Azores benefits from some protection against natural and anthropogenic stressors, it remains vulnerable to climate change, with predictions indicating a decrease of between 23% and 85% in the thermal niche of *L. ochroleuca* by 2100 [199]. Finally, in the Canary Islands, intensified maritime traffic favors invasive species introduction, notably populations of scleractinian corals (*Savalia savaglia*, *Tubastraea sp.*, *Oculina sp.*, *Culicia sp.*), necessitating continuous monitoring of these species [136,200]. Brown macroalgae forest of *Gongolaria abies-marina* transitioned from extensive to fragmented forests in the upper sublittoral

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zone, almost disappearing in areas such as Canary Islands [130,148,151]. This coincides temporally with the increase in marine heatwaves (MHW), which displace species toward cooler waters [201], and with increased coastal urbanization. These activities can also negatively impact seagrass seabeds, causing reduction or disappearance of *C. nodosa* meadows and rhodolith beds, frequently replaced by invasive species (*Caulerpa racemosa, Caulerpa prolifera*) accompanied by cyanobacterial proliferations (*Lyngbya spp*.) [163,195,196,202].

4.2.4. Final Habitat Map in the Central-Eastern Atlantic Archipelagos

Most conservation projects are undertaken within MPAs, whose design has progressively shifted—driven by technological advances and the adoption of ecosystem-based policies—from a focus on single emblematic species to an integrated view of ecosystem functioning. Consistent, high resolution habitat mapping is therefore indispensable for redefining existing MPAs, proposing new ones, and ensuring comparability at the regional scale [3,56,140,203]. For example, Cosme De Esteban et al. (2024) recommended revising an Azorean MPA originally delimited to protect a seabird colony; the absence of a marine component resulted in a buffer zone dominated by sedimentary substrates and excluded reef habitats characterized by cold water corals. Likewise, cartographic and taxonomic surveys along the Mid Atlantic Ridge—sites initially designated as Natura 2000 Sites of Community Importance for cetacean conservation—have revealed extensive mesophotic and deep-water habitats of high ecological value, warranting an expansion of the protection boundaries [140].

4.3. Challenges and Future Implications

Globally, the review of the current status of marine habitat mapping in the oceanic and volcanic archipelagos highlighted two fundamental and interdependent methodological stages: exploration and monitoring. The exploratory stage aims to address initial questions about habitat presence, distribution, and ecological importance, laying the groundwork for subsequent, detailed studies. Clear examples from the Azores and the Canary Islands demonstrate how initial exploration identified essential habitats, such as cold-water coral gardens and rhodolith beds, which might otherwise have been overlooked in marine protected area planning. Conversely, the monitoring stage assesses temporal habitat changes and evaluates the effectiveness of implemented conservation measures, as exemplified in Azores, Madeira and the Canary Islands, where inadequate monitoring has limited effective management of key habitats.

A comprehensive analysis of methodologies and outcomes revealed significant progress in advanced technological applications, particularly in the Azores and Canary Islands, where a wide array of sophisticated tools—such as remote sensing, acoustic, and satellite sensors (e.g., Side-Scan Sonar, MBES)—have been successfully implemented. However, this contrasts sharply with Madeira and especially Cabo Verde, archipelagos constrained by limited technological infrastructure and marine research funding. This regional disparity directly impacts the quality and comprehensiveness of the bionomic maps produced, hindering the necessary interregional comparisons and integrations required for effective integrated management. To address this, regional initiatives promoting technological cooperation and specialized training of local researchers are crucial, as partially achieved by the Azores and Canary Islands through European-funded programs.

Furthermore, integrating and standardizing data generated from diverse methodological techniques remained a significant challenge. The involvement of various stakeholders employing different methodologies resulted in heterogeneous databases, complicating their coherent integration into thematic maps. Studies conducted in the different archipelagos, notably in the Azores, emphasized the imperative need for standardized reference frameworks, systematic field validation (ground-truthing), and robust data validation protocols. Adopting these measures will enhance data reliability and accuracy thereby strengthening predictive modeling capabilities essential for effective marine ecosystem management.

Advanced techniques such as computational modeling, GIS systems, and artificial intelligence have also revolutionized marine mapping in the region. Nevertheless, these technological innovations introduced specific challenges related to processing, analyzing, and interpreting large volumes of data, especially in contexts with limited technological infrastructure. In areas such as Cabo Verde, where technological adoption remains constrained, it is essential to strengthen analytical capabilities and provide specialized training in spatial data processing. Such improvements are crucial for accurate data interpretation and scientifically informed decision-making.

Effective and sustainable management of marine habitats in the Central-Eastern Atlantic archipelagos require an integrated approach that combines biological and geophysical data to produce detailed bionomic maps. In the Azores, the initial lack of such integration resulted in the exclusion of keystone habitats, including CWC, from established MPAs. Therefore, regular updates and continuous refinement of habitat maps, supported by GIS tools and predictive modeling, are essential for accurate ecological assessments of anthropogenic pressures, ensuring the effectiveness of ecosystem-based conservation strategies.

At present time, stronger scientific cooperation about marine habitat mapping will foster more effective decision-making processes in the framework of evolving Marine Spatial Planning activities, where marine conservation sector usually is not so much represented and deserves a more intense focus.

In conclusion, overcoming the challenges identified in this review requires coordinated efforts integrating methodological standardization, investment in advanced technologies, and robust interregional collaboration. The successful implementation of these strategies will substantially enhance the precision of marine habitat mapping in the region, providing a solid foundation for the effective management and conservation on marine ecosystems in face of current and future environmental and anthropogenic pressures.

Supplementary Materials: Searching Formula (**TITLE-ABS-KEY** if searching with SCOPUS**;** and **TS=** if searching with Web of Science): **TITLE-ABS-KEY // TS=** ((“Macarones*” OR “Webbensia” OR “Azore*” OR “Açore*” OR “Madeira*” OR “Wild Island*” OR “Islas Salvajes” OR “Ilhas Salvagens” OR “Desertas Island*” OR “Islas Desertas” OR “Canar*” OR “Canary Island*” OR “Islas Canarias” OR “Cabo Verde” OR “Cape Verde*”) AND (“Acoustic*” OR “Aerial*” OR “Backscatter*” OR “Bathymetr*” OR “Drone*” OR “GIS” OR “Hydroacoustic*” OR “Hydroacoustic Survey*” OR “LIDAR*” OR “Multispectral Imag*” OR “Radar*” OR “Remote Sensing” OR “Satellite*” OR “Scan*” OR “Side Scan Sonar*” OR “Sonar*” OR “Sonic*” OR “Sound*” OR “Spatial Mapping” OR “SSS” OR “Telemetr*” OR “Thermal Imag*” OR “Cartograph*” OR “Coastal Ecosystem Service*” OR “Conservation” OR “Distribut*” OR “Geospatial Data” OR “Habitat*” OR “Habitat Connectiv*” OR “Habitat Mapping” OR “Imaging” OR “Map*” OR “Mapping” OR “Marine Environmental Assessment*” OR “Marine Flora Conservation” OR “Marine Flora Mapping” OR “Marine Habitat Protection” OR “Marine Protected Area*” OR “MBES” OR “Monitoring” OR “MPA*” OR “Seabed Mapping” OR “Spatial Analys*” OR “Multibeam*”) AND (“Zostera” OR “Aquatic Vegetation” OR “Black Coral*” OR “Coral*” OR “Eelgrass*” OR “Forest*” OR “Garden*” OR “Halodule” OR “Halophila” OR “Maerl” OR “MAF*” OR “Nodule*” OR “Rhodolith*” OR “Seagrass*” OR “Seaweed*”))

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Appendix A

Table A1. Table of variables analyzed from the reviewed articles.

Paper	Reference	Year	Zone	Main objective	Habitats			Habitat map	Geological map	Depth (m)	Substrate	Area size (ha)
					Macrophytes	Rhodolith beds	Coral					
1	[175]	2021	Madeira	exploratory	-	x	-	x	-	35	mixed	2,368
2	[198]	2022	Madeira	monitoring	x	-	-	x	-	20	soft	-
3	[131]	2000	Azores	monitoring	x	-	-	-	-	40	hard	-
4	[186]	2000	Azores	exploratory	-	-	x	-	-	3800	hard	-
5	[203]	2008	Azores	monitoring	x	-	-	x	-	30	hard	400
6	[136]	2015	Canary Islands	exploratory	-	-	x	-	-	600	hard	-
7	[140]	2022	Madeira	exploratory	x	x	x	-	-	990	mixed	1,55
8	[165]	2017	Canary Islands	mapping	x	-	-	x	-	20	mixed	-
9	[158]	2022	Azores	exploratory	-	-	x	-	-	210	mixed	0,019
10	[166]	2015	Azores	mapping	x	x	x	x	-	n/a	mixed	167692,2
11	[146]	2023	Canary Islands	mapping	-	-	x	x	-	110	mixed	48,075
12	[116]	2012	Azores	exploratory	-	-	x	-	-	3,3	mixed	-
13	[129]	2017	Azores, Canary Islands	exploratory	x	-	x	-	-	734	mixed	-
14	[204]	1992	Azores	exploratory	x	-	-	x	-	5,5	hard	-

15	[185]	2013	Madeira	mapping	-	-	x	x	x	2660	soft	56000
16	[143]	2020	Azores	exploratory	-	-	x	-	x	1700	hard	0,045
17	[196]	2014	Canary Islands	monitoring	x	-	-	-	-	15	soft	393,9
18	[195]	2014	Azores	monitoring	-	-	x	-	x	1092	hard	-
19	[205]	2021	Azores	exploratory	-	-	x	-	x	595	hard	-
20	[206]	2013	Azores	exploratory	-	-	x	-	x	1097	mixed	2,378
21	[176]	2013	Azores	exploratory	-	-	x	x	-	1500	hard	-
22	[15]	2019	Canary Islands	monitoring	-	x	-	x	-	50	mixed	0,72
23	[164]	2021	Canary Islands	monitoring	x	-	-	-	-	75	soft	-
24	[14]	2020	Canary Islands	monitoring	-	x	-	-	-	40	soft	-
25	[163]	2024	Canary Islands	monitoring	x	x	-	x	-	25	mixed	2150
26	[182]	2024	Cabo Verde	mapping	-	-	x	x	x	2100	hard	118800
27	[130]	2022	Canary Islands	monitoring	x	-	-	-	-	n/a	hard	-
28	[114]	2020	Madeira	mapping	x	x	x	x	-	50	mixed	240
29	[56]	2024	Azores	mapping	x	-	x	x	-	60	mixed	394,08
30	[207]	2018	Canary Islands	mapping	x	-	-	x	-	50	mixed	9138
31	[202]	2013	Canary Islands	exploratory	x	-	-	-	-	19	mixed	-
32	[208]	2019	Madeira	exploratory	x	-	-	-	-	2,6	mixed	-
33	[209]	2006	Azores	exploratory	x	-	-	x	-	20	hard	-
34	[200]	2019	Canary Islands	exploratory	-	-	x	x	-	35	hard	0,018
35	[148]	2024	Canary Islands	monitoring	x	-	-	x	-	50	hard	-

36	[173]	2021	Madeira	monitoring	x	-	-	-	-	12	soft	0,009
37	[4]	2021	Azores	mapping	x	-	-	x	-	15	mixed	-
38	[210]	2012	Canary Islands	exploratory	x	-	-	-	-	46	mixed	-
39	[211]	2002	Canary Islands	mapping	x	-	-	x	-	10	mixed	-
40	[212]	2023	Canary Islands	mapping	x	-	-	x	-	n/a	soft	-
41	[213]	2012	Azores	mapping	-	-	x	-	x	1350	hard	-
42	[214]	2017	Canary Islands	monitoring	x	-	-	x	-	20	hard	7,4
43	[215]	2020	Canary Islands	mapping	x	-	-	x	-	40	mixed	746
44	[162]	2020	Canary Islands	mapping	x	-	-	x	-	40	hard	746
45	[194]	2016	Canary Islands	mapping	-	-	x	-	x	2500	mixed	367388
46	[144]	2020	Azores	exploratory	-	-	x	x	x	4000	mixed	-
47	[216]	2008	Azores	exploratory	-	-	x	-	x	2977	mixed	-
48	[161]	2015	Canary Islands	mapping	x	-	-	x	-	25	mixed	-
49	[197]	2023	Azores	mapping	-	-	x	x	-	2387	mixed	154
50	[142]	2012	Azores	mapping	x	-	-	x	x	80	mixed	53750
51	[217]	2023	Azores	mapping	-	-	x	x	x	2700	hard	-
52	[199]	2021	Azores	exploratory	x	x	-	x	-	85	mixed	-
53	[218]	2023	Cabo Verde	exploratory	x	-	-	x	-	5	soft	0,62
54	[219]	2023	Azores	exploratory	-	-	x	x	-	2000	mixed	2200000
55	[220]	2022	Canary Islands	mapping	x	-	-	x	-	n/a	mixed	-
56	[221]	2008	Azores	monitoring	x	x	x	-	-	30	mixed	-

57	[46]	2020	Canary Islands	mapping	-	-	x	x	-	173	hard	55
58	[201]	2021	Canary Islands	mapping	-	-	x	x	x	3000	mixed	-
59	[141]	2013	Azores	mapping	-	-	x	-	x	160	hard	-
60	[183]	2020	Canary Islands	exploratory	x	-	-	x	-	40	mixed	-
61	[184]	2013	Canary Islands	mapping	x	-	x	x	-	50	mixed	1574
62	[150]	2019	Azores	monitoring	x	-	-	x	-	10	mixed	-
63	[167]	2022	Azores	exploratory	-	-	x	x	x	1600	hard	-
64	[115]	2024	Cabo Verde	exploratory	-	-	x	-	x	3218	mixed	2,807
65	[222]	2013	Canary Islands	exploratory	x	-	-	x	x	45	mixed	-
66	[160]	2023	Canary Islands	mapping	x	-	-	x	-	20	mixed	-
67	[151]	2024	Canary Islands	mapping	x	x	-	x	-	10	mixed	58,5
68	[149]	2021	Madeira	mapping	x	x	-	x	-	14	mixed	10
69	[120]	2008	Azores	mapping	x	-	-	-	-	30	mixed	-

Table A1. *continuum.*

			Methologies								Data classification				
Paper	**Reference**	**Year**	**Direct observation**	**Remote observation**	**Aerial observation**	**Satellite observation**	**Acoustic observation**	**Sampling**	**Bibliographic**	**Modeling**	**GIS tools**	**Acoustic / Bathymetry**	**Image analysis**	**STATS**	**Taxonomic / Morphology**
1	[175]	2021	x	-	-	-	x	x	x	-	x	-	x	-	-
2	[198]	2022	x	-	-	-	x	x	x	x	x	-	-	-	-
3	[131]	2000	-	-	-	-	-	-	x	-	-	-	-	-	-
4	[186]	2000	-	x	-	-	-	-	-	-	-	-	-	-	-

5	[203]	2008	x	-	-	-	-	x	-	-	-	-	-	-	x
6	[136]	2015	x	x	-	-	-	-	x	-	x	-	-	-	-
7	[140]	2022	-	x	-	-	x	-	-	-	-	-	x	-	-
8	[165]	2017	-	-	-	x	-	-	-	x	-	-	-	-	-
9	[158]	2022	-	x	-	-	-	-	-	-	-	-	x	-	-
10	[166]	2015	-	-	-	-	-	-	x	x	x	x	-	-	-
11	[146]	2023	x	x	-	-	x	-	-	x	x	x	-	-	-
12	[116]	2012	-	x	-	-	-	-	x	-	-	-	-	-	-
13	[129]	2017	x	x	-	-	-	-	-	-	-	-	x	-	-
14	[204]	1992	x	-	-	-	-	x	-	-	-	-	-	-	-
15	[185]	2013	-	x	-	-	x	x	-	x	x	x	-	-	-
16	[143]	2020	-	x	-	-	x	-	-	x	-	-	x	-	-
17	[196]	2014	x	-	-	-	-	x	-	x	-	-	-	-	-
18	[195]	2014	x	x	-	-	-	-	-	x	x	-	-	-	-
19	[205]	2021	-	x	-	-	-	-	-	-	-	-	-	-	-
20	[206]	2013	-	x	-	-	-	-	-	-	-	-	x	-	-
21	[176]	2013	x	x	-	-	-	x	x	-	-	-	-	-	-
22	[15]	2019	x	-	-	-	x	x	-	-	x	-	-	-	-
23	[164]	2021	-	-	-	x	-	-	x	x	x	-	-	-	-
24	[14]	2020	x	-	-	-	x	x	-	-	x	-	-	-	-
25	[163]	2024	-	-	-	x	-	-	-	x	-	-	-	x	-

26	[182]	2024	-	x	-	-	x	-	x	x	-	-	x	x	-
27	[130]	2022	x	-	-	-	-	-	x	x	x	-	-	-	-
28	[114]	2020	x	-	-	-	x	-	x	-	x	-	-	-	-
29	[56]	2024	-	x	-	-	x	-	-	-	x	x	-	-	-
30	[207]	2018	x	x	-	-	-	x	-	x	-	-	-	x	-
31	[202]	2013	x	-	-	-	-	x	-	-	-	-	-	-	x
32	[208]	2019	x	-	-	-	-	x	-	-	-	-	x	-	-
33	[209]	2006	x	-	-	-	-	x	-	-	-	-	-	x	-
34	[200]	2019	x	-	-	-	-	x	-	-	-	-	-	-	-
35	[148]	2024	-	-	x	-	-	-	x	x	x	-	x	-	-
36	[173]	2021	x	-	-	-	-	x	-	-	x	-	x	-	-
37	[4]	2021	x	-	x	-	-	x	-	x	x	-	x	x	-
38	[210]	2012	x	-	-	-	-	x	-	-	-	-	-	-	-
39	[211]	2002	-	x	-	-	-	-	-	x	-	-	x	-	-
40	[212]	2023	x	-	-	-	x	-	x	x	x	-	-	-	-
41	[213]	2012	-	-	-	-	-	x	-	-	-	-	-	-	-
42	[214]	2017	x	-	-	-	-	x	-	-	x	-	-	-	-
43	[215]	2020	-	-	-	x	-	-	x	x	-	-	-	-	-
44	[162]	2020	x	-	-	-	-	x	x	x	-	-	-	-	-
45	[194]	2016	-	x	-	-	x	x	-	x	x	x	-	-	-
46	[144]	2020	-	x	-	-	x	-	-	x	-	x	-	-	-

47	[216]	2008	-	x	-	-	-	x	-	-	-	-	-	-	x
48	[161]	2015	-	-	-	x	-	-	-	-	-	-	-	x	-
49	[197]	2023	-	x	-	-	-	-	-	x	-	x	-	-	-
50	[142]	2012	x	x	-	-	x	x	x	x	x	x	-	-	-
51	[217]	2023	-	x	-	-	x	-	-	x	-	x	-	-	-
52	[199]	2021	x	x	-	-	-	x	-	-	-	-	-	-	-
53	[218]	2023	x	-	-	-	-	-	x	-	x	-	-	-	-
54	[219]	2023	-	-	-	-	-	x	-	x	x	-	-	-	-
55	[220]	2022	-	-	-	-	-	-	x	x	-	-	-	x	-
56	[221]	2008	x	-	-	-	-	-	-	-	-	-	-	-	x
57	[46]	2020	x	-	-	-	x	x	-	-	x	x	-	-	-
58	[201]	2021	-	x	-	-	x	x	-	x	x	x	-	-	-
59	[141]	2013	-	x	-	-	x	-	-	-	x	-	-	-	-
60	[183]	2020	x	-	-	-	-	-	-	-	x	-	-	-	-
61	[184]	2013	-	x	-	-	x	-	-	x	x	x	-	x	-
62	[150]	2019	x	-	x	-	-	-	-	x	x	-	x	-	-
63	[167]	2022	-	x	-	-	-	-	-	-	-	x	x	-	-
64	[115]	2024	-	x	-	-	-	-	x	-	x	x	-	-	-
65	[222]	2013	-	-	-	-	x	-	-	x	x	x	-	-	-
66	[160]	2023	-	-	-	x	-	-	-	x	x	-	x	-	-
67	[151]	2024	x	-	x	-	-	x	-	x	x	-	x	x	-

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68	[149]	2021	-	**x**	**x**	-	-	-	-	**x**	**x**	-	**x**	**x**	-
69	[120]	2008	**x**	-	-	-	-	**x**	-	**x**	-	-	**x**	**x**	-

Table A2. Table of species observed and mapped in the reviewed papers.

Species	**Order**	**Family**	**Studies**	**Azores**	**Madeira**	**Canary Islands**	**Cabo Verde**	**Atlantic Mid-Ridge**
Phyllum Cnidaria								
Subphyllum Anthozoa								
Anthozoa			1	x	-	-	-	-
Class Hexacorallia								
Elatopathes aff. abietina (Pourtalès, 1874)	Antipatharia	Aphanipathidae	1	x	-	-	-	-
Actiniaria	Actiniaria		4	x	-	-	x	x
Anemonia viridis (Forsskål, 1775)	Actiniaria	Actiniidae	1	-	x	-	-	-
Actinoscyphia aurelia (Stephenson, 1918)	Actiniaria	Actinoscyphiidae	1	-	-	x	-	-
Parasicyonis ingolfi Carlgren, 1942	Actiniaria	Actinostolidae	1	x	-	-	-	x
Parasicyonis Carlgren, 1921	Actiniaria	Actinostolidae	1	x	-	-	-	x
Telmatactis cricoides (Duchassaing, 1850)	Actiniaria	Andvakiidae	1	-	x	-	-	-
Antipatharia	Antipatharia		3	x	-	-	-	x
Antipathes furcata Gray, 1857	Antipatharia	Antipathidae	1	-	-	x	-	-
Antipathes grayi (Roule, 1902)	Antipatharia	Antipathidae	1	x	-	-	-	-
Antipathes virgata Esper, 1798	Antipatharia	Antipathidae	1	x	-	-	-	-
Antipathes Pallas, 1766	Antipatharia	Antipathidae	2	x	x	-	-	-
Stichopathes flagellum Roule, 1902	Antipatharia	Antipathidae	1	x	-	-	-	-
Stichopathes gracilis (Gray, 1857)	Antipatharia	Antipathidae	1	x	-	x	-	x

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Stichopathes gravieri Molodtsova, 2006	Antipatharia	Antipathidae	2	x	-	-	-	x
Stichopathes richardi Roule, 1902	Antipatharia	Antipathidae	1	x	-	-	-	-
Stichopathes Brook, 1889	Antipatharia	Antipathidae	4	x	x	x	-	x
Elatopathes Opresko, 2004	Antipatharia	Aphanipathidae	1	x	-	-	-	x
Aphanostichopathes dissimilis (Roule, 1902)	Antipatharia	Aphanipathidae	1	x	-	-	-	-
Distichopathes Opresko, 2004	Antipatharia	Aphanipathidae	2	x	x	-	-	-
Phanopathes erinaceus (Roule, 1905)	Antipatharia	Aphanipathidae	2	x	-	-	-	-
Heteropathes Opresko, 2011	Antipatharia	Cladopathidae	1	x	-	-	-	x
Leiopathes expansa Johnson, 1899	Antipatharia	Leiopathidae	2	x	-	-	-	x
Leiopathes glaberrima (Esper, 1792)	Antipatharia	Leiopathidae	3	x	-	x	-	-
Leiopathes grimaldii Roule, 1902	Antipatharia	Leiopathidae	1	x	-	-	-	-
Leiopathes Haime, 1849	Antipatharia	Leiopathidae	1	x	-	x	-	x
Leiopathes Haime, 1849	Antipatharia	Leiopathidae	4	x	-	x	-	x
Antipathella subpinnata (Ellis & Solander, 1786)	Antipatharia	Myriopathidae	4	x	-	x	-	x
Antipathella wollastoni (Gray, 1857)	Antipatharia	Myriopathidae	8	x	-	x	-	x
Antipathella Brook, 1889	Antipatharia	Myriopathidae	3	x	-	x	-	x
Tanacetipathes squamosa (Koch, 1886)	Antipatharia	Myriopathidae	1	x	-	-	-	-
Tanacetipathes Opresko, 2001	Antipatharia	Myriopathidae	4	x	x	-	-	x
Bathypathes patula Brook, 1889	Antipatharia	Schizopathidae	1	x	-	-	-	-
Bathypathes Brook, 1889	Antipatharia	Schizopathidae	3	x	-	x	-	x
Stauropathes punctata (Roule, 1905)	Antipatharia	Schizopathidae	1	x	-	-	-	-

Stauropathes arctica (Lütken, 1871)	Antipatharia	Schizopathidae	1	x	-	-	-	x
Parantipathes hirondelle Molodtsova, 2006	Antipatharia	Schizopathidae	2	x	-	-	-	-
Parantipathes Brook, 1889	Antipatharia	Schizopathidae	2	x	x	-	-	x
Ceriantharia	Ceriantharia		1	x	-	-	-	-
Pachycerianthus Roule, 1904	Ceriantharia	Cerianthidae	1	-	x	-	-	-
Scleractinia	Scleractinia		2	x	-	-	-	x
Coenocyathus cylindricus Milne Edwards y Haime, 1848	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Concentrotheca laevigata (Pourtalès, 1871)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Dasmosmilia lymani (Pourtalès, 1871)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Dasmosmilia variegata (Pourtalès, 1871)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Desmophyllum dianthus (Esper, 1794)	Scleractinia	Caryophylliidae	5	x	-	-	-	x
Desmophyllum pertusum (Linnaeus, 1758)	Scleractinia	Caryophylliidae	8	x	-	x	-	x
Desmophyllum Ehrenberg, 1834	Scleractinia	Caryophylliidae	2	x	-	x	-	x
Pourtalosmilia anthophyllites (Ellis & Solander, 1786)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Premocyathus cornuformis (Pourtalès, 1868)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Anomocora fecunda (Pourtalès, 1871)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Paracyathus pulchellus (Philippi, 1842)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Phyllangia americana Milne Edwards & Haime, 1849	Scleractinia	Caryophylliidae	1	-	-	x	-	-
Polycyathus muellerae (Abel, 1959)	Scleractinia	Caryophylliidae	1	-	-	x	-	-
Polycyathus senegalensis Chevalier, 1966	Scleractinia	Caryophylliidae	1	-	-	x	-	-
Aulocyathus atlanticus Zibrowius, 1980	Scleractinia	Caryophylliidae	2	x	x	-	-	x

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Caryophyllia (Caryophyllia) abyssorum Duncan, 1873	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Caryophyllia (Caryophyllia) alberti Zibrowius, 1980	Scleractinia	Caryophylliidae	3	x	-	-	-	x
Caryophyllia (Caryophyllia) atlantica (Duncan, 1873)	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Caryophyllia (Caryophyllia) calveri Duncan, 1873	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Caryophyllia (Caryophyllia) cyathus (Ellis & Solander, 1786)	Scleractinia	Caryophylliidae	2	x	-	-	-	x
Caryophyllia (Caryophyllia) foresti Zibrowius, 1980	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Caryophyllia (Caryophyllia) inornata (Duncan, 1878)	Scleractinia	Caryophylliidae	2	x	-	x	-	-
Caryophyllia (Caryophyllia) sarsiae Zibrowius, 1974	Scleractinia	Caryophylliidae	2	x	-	-	-	x
Caryophyllia (Caryophyllia) smithii Stokes & Broderip, 1828	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Caryophyllia (Caryophyllia) Lamarck, 1801	Scleractinia	Caryophylliidae	5	x	-	x	-	x
Caryophylliidae Dana, 1846	Scleractinia	Caryophylliidae	2	x	-	-	-	x
Solenosmilia variabilis Duncan, 1873	Scleractinia	Caryophylliidae	5	x	-	x	-	x
Solenosmilia Duncan, 1873	Scleractinia	Caryophylliidae	1	x	-	-	-	x
Tethocyathus variabilis Cairns, 1979	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Trochocyathus (Trochocyathus) spinosocostatus Zibrowius, 1980	Scleractinia	Caryophylliidae	1	x	-	-	-	-
Deltocyathus eccentricus Cairns, 1979	Scleractinia	Deltocyathidae	2	x	x	-	-	x
Deltocyathus italicus (Michelotti, 1838)	Scleractinia	Deltocyathidae	1	x	-	-	-	-
Deltocyathus moseleyi Cairns, 1979	Scleractinia	Deltocyathidae	2	x	x	-	-	x
Dendrophyllia alternata Pourtalès, 1880	Scleractinia	Dendrophylliidae	2	x	-	x	-	x
Dendrophyllia cornigera (Lamarck, 1816)	Scleractinia	Dendrophylliidae	4	x	x	x	-	x
Dendrophyllia ramea (Linnaeus, 1758)	Scleractinia	Dendrophylliidae	4	x	x	x	-	x

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Dendrophyllia de Blainville, 1830	Scleractinia	Dendrophylliidae	2	x	-	-	-	x
Enallopsammia pusilla (Alcock, 1902)	Scleractinia	Dendrophylliidae	1	x	-	-	-	-
Enallopsammia rostrata (Pourtalès, 1878)	Scleractinia	Dendrophylliidae	4	x	-	-	x	x
Enallopsammia Michelloti, 1871	Scleractinia	Dendrophylliidae	1	x	-	-	-	x
Leptopsammia formosa (Gravier, 1915)	Scleractinia	Dendrophylliidae	2	x	-	-	-	-
Balanophyllia (Balanophyllia) cellulosa Duncan, 1873	Scleractinia	Dendrophylliidae	2	x	-	-	-	x
Tubastraea coccinea Lesson, 1830	Scleractinia	Dendrophylliidae	1	-	-	x	-	-
Tubastraea tagusensis Wells, 1982	Scleractinia	Dendrophylliidae	1	-	-	x	-	-
Tubastraea Lesson, 1830	Scleractinia	Dendrophylliidae	1	-	-	x	-	-
Javania cailleti (Duchassaing & Michelotti, 1864)	Scleractinia	Flabellidae	1	x	-	-	-	-
Javania pseudoalabastra Zibrowius, 1974	Scleractinia	Flabellidae	1	x	-	-	-	-
Flabellum (Flabellum) chunii Marenzeller, 1904	Scleractinia	Flabellidae	1	x	-	-	-	-
Flabellum (Ulocyathus) alabastrum Moseley, 1876	Scleractinia	Flabellidae	2	x	-	-	-	x
Flabellum (Ulocyathus) angulare Moseley, 1876	Scleractinia	Flabellidae	2	x	-	-	-	x
Flabellum (Ulocyathus) macandrewi Gray, 1849	Scleractinia	Flabellidae	2	x	-	-	-	x
Flabellum Lesson, 1831	Scleractinia	Flabellidae	3	x	-	-	-	x
Fungiacyathus (Bathyactis) crispus (Pourtalès, 1871)	Scleractinia	Fungiacyathidae	2	x	-	-	-	x
Fungiacyathus (Bathyactis) marenzelleri (Vaughan, 1906)	Scleractinia	Fungiacyathidae	1	x	-	-	-	-
Fungiacyathus (Bathyactis) symmetricus (Pourtalès, 1871)	Scleractinia	Fungiacyathidae	1	x	-	-	-	-
Fungiacyathus (Fungiacyathus) fragilis Sars, 1872	Scleractinia	Fungiacyathidae	3	x	-	-	-	x
Guynia annulata Duncan, 1872	Scleractinia	Guyniidae	1	x	-	-	-	-

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Madrepora oculata Linnaeus, 1758	Scleractinia	Madreporidae	8	x	x	x	-	x
Oculina patagonica de Angelis D'Ossat, 1908	Scleractinia	Oculinidae	1	-	-	x	-	-
Oculina Lamarck, 1816	Scleractinia	Oculinidae	1	-	-	x	-	-
Madracis pharensis (Heller, 1868)	Scleractinia	Pocilloporidae	1	x	-	-	-	-
Madracis profunda Zibrowius, 1980	Scleractinia	Pocilloporidae	1	x	-	-	-	-
Madracis Milne Edwards & Haime, 1849	Scleractinia	Pocilloporidae	1	-	x	-	-	-
Culicia tenella Dana, 1846	Scleractinia	Rhizangiidae	1	-	-	x	-	-
Culicia Dana, 1846	Scleractinia	Rhizangiidae	1	-	-	x	-	-
Schizocyathidae Stolarski, 2000	Scleractinia	Schizocyathidae	1	x	-	-	-	x
Schizocyathus fissilis Pourtalès, 1874	Scleractinia	Schizocyathidae	1	x	-	-	-	-
Stenocyathus vermiformis (Pourtalès, 1868)	Scleractinia	Stenocyathidae	3	x	x	-	-	x
Stephanocyathus (Odontocyathus) nobilis (Moseley, 1876)	Scleractinia	Stephanocyathidae	1	x	-	-	-	-
Stephanocyathus (Stephanocyathus) crassus (Jourdan, 1895)	Scleractinia	Stephanocyathidae	1	x	-	-	-	-
Stephanocyathus (Stephanocyathus) diadema (Moseley, 1876)	Scleractinia	Stephanocyathidae	1	x	-	-	-	-
Stephanocyathus (Stephanocyathus) moseleyanus (Sclater, 1886)	Scleractinia	Stephanocyathidae	2	x	-	-	-	x
Vaughanella concinna Gravier, 1915	Scleractinia	Stephanocyathidae	1	x	-	-	-	-
Peponocyathus stimpsonii (Pourtalès, 1871)	Scleractinia	Turbinoliidae	1	x	-	-	-	-
Sphenotrochus (Sphenotrochus) andrewianus Milne Edwards & Haime, 1848	Scleractinia	Turbinoliidae	1	x	-	-	-	-
Thrypticotrochus Cairns, 1989	Scleractinia	Turbinoliidae	1	-	-	-	-	x
Peponocyathus folliculus (Pourtalès, 1868)	Scleractinia	Turbinoliidae	2	x	x	-	-	x

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Zoantharia	Zoantharia		1	x	-	-	-	x
Epizoanthus martinsae Carreiro-Silva, Ocaña, Stanković, Sampaio, Porteiro, Fabri & Stefanni, 2017	Zoantharia	Epizoanthidae	1	x	-	-	-	-
Parazoanthus Haddon & Shackleton, 1891	Zoantharia	Parazoanthidae	1	x	-	x	-	x
Savalia savaglia (Bertoloni, 1819)	Zoantharia	Parazoanthidae	1	-	-	x	-	-
Palythoa canariensis Haddon & Duerden, 1896	Zoantharia	Sphenopidae	1	-	-	x	-	-
Zoanthidae Rafinesque, 1815	Zoantharia	Zoanthidae	2	x	-	-	-	x
Class Octocorallia								
Octocorallia			5	x	-	x	x	x
Rolandia coralloides de Lacaze Duthiers, 1900	Alcyonacea	Clavulariidae	1	x	-	-	-	-
Malacalcyonacea	Malacalcyonacea		1	x	-	-	-	-
Acanthogorgia armata Verrill, 1878	Malacalcyonacea	Acanthogorgiidae	3	x	-	-	-	x
Acanthogorgia aspera Pourtalès, 1867	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Acanthogorgia hirsuta Gray, 1857	Malacalcyonacea	Acanthogorgiidae	3	x	-	x	-	x
Acanthogorgia muricata Verrill, 1883	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Acanthogorgia pico Grasshoff, 1973	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Acanthogorgia sp. Gray, 1857	Malacalcyonacea	Acanthogorgiidae	4	x	-	x	-	x
Bebryce mollis Philippi, 1842	Malacalcyonacea	Acanthogorgiidae	3	x	x	-	-	x
Dentomuricea meteor Grasshoff, 1977	Malacalcyonacea	Acanthogorgiidae	7	x	x	x	-	x
Dentomuricea Grasshoff, 1977	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	x
Muriceides lepida Carpine & Grasshoff, 1975	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Muriceides sceptrum (Studer, 1891)	Malacalcyonacea	Acanthogorgiidae	2	x	-	-	-	x

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Placogorgia becena Grasshoff, 1977	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Placogorgia coronata Carpine & Grasshoff, 1975	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Placogorgia intermedia (Thomson, 1927)	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Villogorgia bebrycoides (von Koch, 1887)	Malacalcyonacea	Acanthogorgiidae	2	x	-	-	-	x
Gersemia clavata (Danielssen, 1887)	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Azoriella bayeri (López-González & Gili, 2001)	Malacalcyonacea	Cerveridae	1	x	-	-	-	-
Clavularia arctica (Sars, 1860)	Malacalcyonacea	Clavulariidae	1	x	-	-	-	-
Clavularia armata Thomson, 1927	Malacalcyonacea	Clavulariidae	1	x	-	-	-	-
Clavularia charcoti (Tixier-Durivault & d'Hondt, 1974)	Malacalcyonacea	Clavulariidae	1	x	-	-	-	-
Clavularia elongata Wright & Studer, 1889	Malacalcyonacea	Clavulariidae	1	x	-	-	-	-
Clavularia marioni von Koch, 1890	Malacalcyonacea	Clavulariidae	1	x	-	-	-	-
Clavularia tenuis Tixier-Durivault & d'Hondt, 1974	Malacalcyonacea	Clavulariidae	1	x	-	-	-	-
Clavularia Blainville, 1830	Malacalcyonacea	Clavulariidae	1	x	-	-	-	x
Schizophytum echinatum Studer, 1891	Malacalcyonacea	Clavulariidae	2	x	-	-	-	x
Eunicella verrucosa (Pallas, 1766)	Malacalcyonacea	Eunicellidae	1	-	x	-	-	-
Eunicella Verrill, 1869	Malacalcyonacea	Eunicellidae	1	-	x	-	-	-
Pseudotelestula humilis (Thomson, 1927)	Malacalcyonacea	Incrustatidae	1	x	-	-	-	-
Thesea rigida (Thomson, 1927)	Malacalcyonacea	Malacalcyonacea incertae sedis	1	x	-	-	-	-
Nephtheidae Gray, 1862	Malacalcyonacea	Nephtheidae	1	-	x	-	-	-
Scleronephthya macrospina Thomson, 1927	Malacalcyonacea	Nephtheidae	1	x	-	-	-	-

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Plexauridae Gray, 1859	Malacalcyonacea	Plexauridae	3	x	-	-	-	x
Dacrygorgia modesta (Verrill, 1883)	Malacalcyonacea	Pterogorgiidae	1	x	-	-	-	-
Sarcophyton Lesson, 1834	Malacalcyonacea	Sarcophytidae	1	-	x	-	-	-
Bathytelesto rigida (Wright & Studer, 1889)	Malacalcyonacea	Tubiporidae	1	x	-	-	-	-
Scyphopodium ingolfi (Madsen, 1944)	Malacalcyonacea	Tubiporidae	1	x	-	-	-	-
Scleranthelia rugosa (Pourtalès, 1867)	Octocorallia incertae sedis	Octocorallia incertae sedis	1	x	-	-	-	-
Scleralcyonacea	Scleralcyonacea		2	x	-	-	x	x
Chelidonisis aurantiaca Studer, 1890	Scleralcyonacea	Chelidonisididae	2	x	-	-	-	-
Chrysogorgia agassizii (Verrill, 1883)	Scleralcyonacea	Chrysogorgiidae	3	x	-	-	-	x
Chrysogorgia fewkesii Verrill, 1883	Scleralcyonacea	Chrysogorgiidae	1	x	-	-	-	-
Chrysogorgia quadruplex Thomson, 1927	Scleralcyonacea	Chrysogorgiidae	1	x	-	-	-	-
Chrysogorgia Duchassaing & Michelotti, 1864	Scleralcyonacea	Chrysogorgiidae	3	x	-	x	-	x
Parachrysogorgia squamata (Verrill, 1883)	Scleralcyonacea	Chrysogorgiidae	1	x	-	-	-	-
Radicipes gracilis (Verrill, 1884)	Scleralcyonacea	Chrysogorgiidae	2	x	-	-	-	-
Chrysogorgia elegans (Verrill, 1883)	Scleralcyonacea	Chrysogorgiidae	1	x	-	-	-	-
Pleurocorallium johnsoni (Gray, 1860)	Scleralcyonacea	Coralliidae	3	x	-	-	-	x
Coralliidae Lamouroux, 1812	Scleralcyonacea	Coralliidae	4	x	-	-	-	x
Cornularia cornucopiae (Pallas, 1766)	Scleralcyonacea	Cornulariidae	1	x	-	-	-	-
Viminella flagellum (Johnson, 1863)	Scleralcyonacea	Ellisellidae	8	x	x	x	-	x
Acanella arbuscula (Johnson, 1862)	Scleralcyonacea	Keratoisididae	5	x	-	x	x	x

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Calyptrophora trilepis (Pourtalès, 1868)	Scleralcyonacea	Primnoidae	1	x	-	x	-	x
Candidella imbricata (Johnson, 1862)	Scleralcyonacea	Primnoidae	5	x	-	-	-	x
Narella bellissima (Kükenthal, 1915)	Scleralcyonacea	Primnoidae	4	x	-	-	-	x
Narella versluysi (Hickson, 1909)	Scleralcyonacea	Primnoidae	3	x	-	-	-	x
Paracalyptrophora josephinae (Lindström, 1877)	Scleralcyonacea	Primnoidae	4	x	-	-	-	x
Primnoidae Milne Edwards, 1857	Scleralcyonacea	Primnoidae	3	x	-	-	-	x
Thouarella (Euthouarella) grasshoffi Cairns, 2006	Scleralcyonacea	Primnoidae	1	x	-	-	-	-
Thouarella (Euthouarella) hilgendorfi (Studer, 1879)	Scleralcyonacea	Primnoidae	1	x	-	-	-	x
Thouarella (Thouarella) variabilis Wright & Studer, 1889	Scleralcyonacea	Primnoidae	1	x	-	-	-	-
Thouarella Gray, 1870	Scleralcyonacea	Primnoidae	2	x	-	-	-	x
Sarcodictyon catenatum Forbes in Johnston, 1847	Scleralcyonacea	Sarcodictyonidae	2	x	-	-	-	x
Telestula batoni Weinberg, 1990	Scleralcyonacea	Sarcodictyonidae	1	x	-	-	-	-
Telestula kuekenthali Weinberg, 1990	Scleralcyonacea	Sarcodictyonidae	1	x	-	-	-	-
Telestula tubaria Wright & Studer, 1889	Scleralcyonacea	Sarcodictyonidae	1	x	-	-	-	-
Scleroptilum grandiflorum Kölliker, 1880	Scleralcyonacea	Scleroptilidae	1	x	-	-	-	x
Titanideum obscurum Thomson, 1927	Scleralcyonacea	Spongiodermidae	1	x	-	-	-	-
Paramuricea candida Grasshoff, 1977	Malacalcyonacea	Acanthogorgiidae	1	x	-	-	-	-
Paramuricea grayi (Johnson, 1861)	Malacalcyonacea	Acanthogorgiidae	1	-	x	-	-	-
Paramuricea Kölliker, 1865	Malacalcyonacea	Acanthogorgiidae	5	x	-	x	x	x
Alcyoniidae Lamouroux, 1812	Malacalcyonacea	Alcyoniidae	3	x	-	-	-	x
Alcyonium bocagei (Saville Kent, 1870)	Malacalcyonacea	Alcyoniidae	2	x	-	-	-	x

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Alcyonium burmedju Sampaio, Stokvis & van Ofwegen, 2016	Malacalcyonacea	Alcyoniidae	2	x	-	-	-	x
Alcyonium maristenebrosi (Stiasny, 1937)	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Alcyonium palmatum Pallas, 1766	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Alcyonium profundum Stokvis & van Ofwegen, 2006	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Alcyonium Linnaeus, 1758	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	x
Anthothela grandiflora (Sars, 1856)	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Bellonella tenuis Tixier-Durivault & d'Hondt, 1974	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Bellonella variabilis (Studer, 1891)	Malacalcyonacea	Alcyoniidae	1	x	-	-	-	-
Lateothela grandiflora (Tixier-Durivault & d'Hondt, 1974)	Malacalcyonacea	Alcyoniidae	2	x	-	-	-	-
Isididae Lamouroux, 1812	Malacalcyonacea	Isididae	2	x	-	-	-	x
Paralcyonium spinulosum (Delle Chiaje, 1822)	Malacalcyonacea	Paralcyoniidae	1	x	-	-	-	-
Swiftia dubia (Thomson, 1929)	Malacalcyonacea	Plexauridae	2	x	-	-	-	x
Swiftia Duchassaing & Michelotti, 1864	Malacalcyonacea	Plexauridae	2	x	-	x	-	-
Pennatuloidea Ehrenberg, 1834	Scleralcyonacea		2	x	-	-	-	x
Anthoptilum Kölliker, 1880	Scleralcyonacea	Anthoptilidae	1	x	-	-	-	x
Iridogorgia fontinalis Watling, 2007	Scleralcyonacea	Chrysogorgiidae	1	x	-	-	-	-
Iridogorgia pourtalesii Verrill, 1883	Scleralcyonacea	Chrysogorgiidae	1	x	-	-	-	-
Iridogorgia Verrill, 1883	Scleralcyonacea	Chrysogorgiidae	2	x	-	-	x	x
Metallogorgia melanotrichos (Wright & Studer, 1889)	Scleralcyonacea	Chrysogorgiidae	2	x	-	x	-	-
Metallogorgia Versluys, 1902	Scleralcyonacea	Chrysogorgiidae	1	-	-	-	x	-
Corallium Cuvier, 1798	Scleralcyonacea	Coralliidae	2	x	-	x	-	x

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Hemicorallium niobe (Bayer, 1964)	Scleralcyonacea	Coralliidae	3	x	-	x	-	-
Hemicorallium tricolor (Johnson, 1899)	Scleralcyonacea	Coralliidae	2	x	-	x	-	-
Paragorgia arborea (Linnaeus, 1758)	Scleralcyonacea	Coralliidae	1	x	-	-	-	x
Paragorgia johnsoni Gray, 1862	Scleralcyonacea	Coralliidae	4	x	-	-	-	x
Anthomastus canariensis Wright & Studer, 1889	Scleralcyonacea	Coralliidae	1	x	-	-	-	-
Anthomastus grandiflorus Verrill, 1878	Scleralcyonacea	Coralliidae	1	x	-	-	-	-
Anthomastus Verrill, 1878	Scleralcyonacea	Coralliidae	4	x	-	x	-	x
Pseudoanthomastus agaricus (Studer, 1890)	Scleralcyonacea	Coralliidae	2	x	-	-	-	x
Pseudoanthomastus Tixier-Durivault & d'Hondt, 1974	Scleralcyonacea	Coralliidae	1	x	-	-	-	-
Nicella granifera (Kölliker, 1865)	Scleralcyonacea	Ellisellidae	1	x	-	-	-	-
Gyrophyllum hirondellei Studer, 1891	Scleralcyonacea	Gyrophyllidae	1	x	-	-	-	-
Isidella longiflora (Verrill, 1883)	Scleralcyonacea	Keratoisididae	1	x	-	-	-	-
Lepidisis cyanae Grasshoff, 1986	Scleralcyonacea	Keratoisididae	1	x	-	-	-	-
Lepidisis Verrill, 1883	Scleralcyonacea	Keratoisididae	1	x	-	-	-	-
Keratoisididae Gray, 1870	Scleralcyonacea	Keratoisididae	1	x	-	-	-	x
Keratoisis grayi Wright, 1869	Scleralcyonacea	Keratoisididae	1	x	-	-	-	-
Keratoisis Wright, 1869	Scleralcyonacea	Keratoisididae	3	x	-	x	-	x
Pennatula Linnaeus, 1758	Scleralcyonacea	Pennatulidae	1	-	-	x	-	-
Callogorgia verticillata (Pallas, 1766)	Scleralcyonacea	Primnoidae	4	x	-	x	-	x
Paracalyptrophora Kinoshita, 1908	Scleralcyonacea	Primnoidae	1	x	-	-	-	x
Umbellula Cuvier, [1797]	Scleralcyonacea	Umbellulidae	1	x	-	-	-	x

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Veretillum cynomorium (Pallas, 1766)	Scleralcyonacea	Veretillidae	1	-	x	-	-	-
Subphyllum Medusozoa								
Class Hydrozoa								
Hydrozoa			1	x	-	-	-	x
Candelabrum phrygium (Fabricius, 1780)	Anthoathecata	Candelabridae	1	x	-	-	-	x
Candelabrum serpentarii Segonzac & Vervoort, 1995	Anthoathecata	Candelabridae	1	x	-	-	-	x
Eudendrium Ehrenberg, 1834	Anthoathecata	Eudendriidae	1	x	-	-	-	x
Pennaria disticha Goldfuss, 1820	Anthoathecata	Pennariidae	1	-	x	-	-	-
Errina atlantica Hickson, 1912	Anthoathecata	Stylasteridae	2	x	-	-	-	x
Errina dabneyi (Pourtalès, 1871)	Anthoathecata	Stylasteridae	5	x	-	x	-	x
Errina Gray, 1835	Anthoathecata	Stylasteridae	2	x	x	-	-	x
Stenohelia Kent, 1870	Anthoathecata	Stylasteridae	2	x	x	-	-	x
Stylaster Gray, 1831	Anthoathecata	Stylasteridae	1	-	x	-	-	x
Stylasteridae Gray, 1847	Anthoathecata	Stylasteridae	5	x	-	-	-	x
Pliobothrus symmetricus Pourtalès, 1868	Anthoathecata	Stylasteridae	2	x	-	-	-	x
Crypthelia affinis Moseley, 1879	Anthoathecata	Stylasteridae	1	x	-	-	-	-
Crypthelia medioatlantica Zibrowius & Cairns, 1992	Anthoathecata	Stylasteridae	1	x	-	-	-	-
Crypthelia tenuiseptata Cairns, 1986	Anthoathecata	Stylasteridae	1	x	-	-	-	-
Crypthelia vascomarquesi Zibrowius & Cairns, 1992	Anthoathecata	Stylasteridae	1	x	-	-	-	-
Crypthelia Milne Edwards & Haime, 1849	Anthoathecata	Stylasteridae	2	x	-	-	-	x
Lepidopora eburnea (Calvet, 1903)	Anthoathecata	Stylasteridae	1	x	-	-	-	-
Lepidopora Pourtalès, 1871	Anthoathecata	Stylasteridae	1	-	x	-	-	x

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Ectopleura crocea (Agassiz, 1862)	Anthoathecata	Tubulariidae	1	-	x	-	-	-
Macrorhynchia philippina Kirchenpauer, 1872	Leptothecata	Aglaopheniidae	2	-	x	-	-	-
Macrorhynchia Kirchenpauer, 1872	Leptothecata	Aglaopheniidae	1	-	x	-	-	-
Aglaophenia lophocarpa Allman, 1877	Leptothecata	Aglaopheniidae	1	x	-	-	-	x
Aglaophenia pluma (Linnaeus, 1758)	Leptothecata	Aglaopheniidae	1	-	x	-	-	-
Aglaophenia Lamouroux, 1812	Leptothecata	Aglaopheniidae	3	x	x	x	-	x
Lytocarpia myriophyllum (Linnaeus, 1758)	Leptothecata	Aglaopheniidae	5	x	-	x	-	x
Obelia geniculata (Linnaeus, 1758)	Leptothecata	Campanulariidae	1	x	-	-	-	-
Halecium Oken, 1815	Leptothecata	Haleciidae	1	x	-	-	-	x
Polyplumaria flabellata Sars, 1874	Leptothecata	Halopterididae	5	x	-	x	-	x
Polyplumaria Sars, 1874	Leptothecata	Halopterididae	1	x	-	-	-	x
Antennella secundaria (Gmelin, 1791)	Leptothecata	Halopterididae	1	x	-	-	-	x
Antennella Allman, 1877	Leptothecata	Halopterididae	1	-	x	-	-	-
Kirchenpaueria halecioides (Alder, 1859)	Leptothecata	Kirchenpaueriidae	1	-	x	-	-	-
Filellum serratum (Clarke, 1879)	Leptothecata	Lafoeidae	1	x	-	-	-	x
Grammaria abietina (Sars, 1851)	Leptothecata	Lafoeidae	1	x	-	-	-	x
Acryptolaria conferta (Allman, 1877)	Leptothecata	Lafoeidae	1	x	-	-	-	x
Acryptolaria crassicaulis (Allman, 1888)	Leptothecata	Lafoeidae	1	x	-	-	-	x
Acryptolaria Norman, 1875	Leptothecata	Lafoeidae	1	x	-	x	-	x
Nemertesia antennina (Linnaeus, 1758)	Leptothecata	Plumulariidae	3	x	-	x	-	x
Nemertesia ramosa (Lamarck, 1816)	Leptothecata	Plumulariidae	1	-	x	-	-	-

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Nemertesia Lamouroux, 1812	Leptothecata	Plumulariidae	1	x	-	-	-	x
Plumulariidae McCrady, 1859	Leptothecata	Plumulariidae	1	x	-	x	-	x
Sertularella gayi (Lamouroux, 1821)	Leptothecata	Sertularellidae	1	x	-	-	-	x
Sertularella Gray, 1848	Leptothecata	Sertularellidae	1	-	x	-	-	x
Diphasia alata (Hincks, 1855)	Leptothecata	Sertulariidae	1	x	-	x	-	x
Diphasia margareta (Hassall, 1841)	Leptothecata	Sertulariidae	1	x	-	-	-	x
Diphasia Agassiz, 1862	Leptothecata	Sertulariidae	2	x	-	-	-	x
Dynamena Lamouroux, 1812	Leptothecata	Sertulariidae	1	-	x	-	-	-
Cryptolaria pectinata (Allman, 1888)	Leptothecata	Zygophylacidae	1	x	-	-	-	x
Cryptolaria Busk, 1857	Leptothecata	Zygophylacidae	1	x	-	x	-	x
Zygophylax biarmata Billard, 1905	Leptothecata	Zygophylacidae	1	x	-	-	-	x
Phyllum Chlorophyta								
Subphyllum Chlorophytina								
Class Ulvophyceae								
Bryopsis J.V.Lamouroux, 1809	Bryopsidales	Bryopsidaceae	1	-	x	-	-	-
Caulerpa cylindracea Sonder, 1845	Bryopsidales	Caulerpaceae	1	-	-	x	-	-
Caulerpa mexicana Sonder ex Kützing, 1849	Bryopsidales	Caulerpaceae	1	-	-	x	-	-
Caulerpa prolifera (Forsskål) J.V.Lamouroux, 1809	Bryopsidales	Caulerpaceae	7	-	x	x	-	-
Caulerpa racemosa (Forsskål) J.Agardh, 1873	Bryopsidales	Caulerpaceae	1	-	-	x	-	-
Caulerpa webbiana f. disticha Vickers, 1896	Bryopsidales	Caulerpaceae	1	-	-	x	-	-
Caulerpa webbiana Montagne, 1837	Bryopsidales	Caulerpaceae	1	-	x	-	-	-
Caulerpa J.V.Lamouroux, 1809	Bryopsidales	Caulerpaceae	4	-	-	x	-	-

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Codium adhaerens C.Agardh, 1822	Bryopsidales	Codiaceae	4	x	-	-	-	-
Codium elisabethiae O.C.Schmidt, 1929	Bryopsidales	Codiaceae	2	x	-	-	-	-
Codium fragile subsp. fragile (Suringar) Hariot, 1889	Bryopsidales	Codiaceae	1	x	-	-	-	-
Codium fragile (Suringar) Hariot, 1889	Bryopsidales	Codiaceae	1	x	-	-	-	-
Avrainvillea canariensis A.Gepp & E.S.Gepp, 1911	Bryopsidales	Dichotomosiphonaceae	1	-	x	-	-	-
Halimeda incrassata (J.Ellis) J.V.Lamouroux, 1816	Bryopsidales	Halimedaceae	1	-	-	x	-	-
Anadyomene stellata (Wulfen) C.Agardh, 1823	Cladophorales	Anadyomenaceae	1	-	-	x	-	-
Microdictyon calodictyon (Montagne) Kützing, 1849	Cladophorales	Anadyomenaceae	1	-	-	x	-	-
Microdictyon Decaisne, 1841	Cladophorales	Anadyomenaceae	1	-	-	x	-	-
Cladophoropsis membranacea Bang ex C.Agardh) Børgesen, 1905	Cladophorales	Boodleaceae	1	x	-	-	-	-
Chaetomorpha aerea (Dillwyn) Kützing, 1849	Cladophorales	Cladophoraceae	2	x	-	-	-	-
Chaetomorpha pachynema (Montagne) Kützing, 1847	Cladophorales	Cladophoraceae	2	x	-	-	-	-
Chaetomorpha Kützing, 1845	Cladophorales	Cladophoraceae	2	x	-	x	-	-
Pseudorhizoclonium africanum (Kützing) Boedeker, 2016	Cladophorales	Cladophoraceae	1	x	-	-	-	-
Cladophora albida (Nees) Kutzing, 1843	Cladophorales	Cladophoraceae	1	x	-	-	-	-
Cladophora coelothrix Kützing, 1843	Cladophorales	Cladophoraceae	1	x	-	-	-	-
Cladophora prolifera (Roth) Kützing, 1843	Cladophorales	Cladophoraceae	3	x	-	-	-	-
Cladophora Kützing, 1843	Cladophorales	Cladophoraceae	3	x	-	x	-	-
Valonia utricularis (Roth) C.Agardh, 1823	Cladophorales	Valoniaceae	1	x	-	-	-	-
Valonia C.Agardh, 1823	Cladophorales	Valoniaceae	1	x	-	-	-	-

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Cymopolia barbata (Linnaeus) J.V.Lamouroux, 1816	Dasycladales	Dasycladaceae	1	-	-	x	-	-
Dasycladus vermicularis (Scopoli) Krasser, 1898	Dasycladales	Dasycladaceae	1	-	x	-	-	-
Dasycladus C.Agardh, 1828	Dasycladales	Dasycladaceae	1	-	-	x	-	-
Parvocaulis parvulus (Solms-Laubach) S.Berger, Fettweiss, Gleissberg, Liddle, U.Richter, Sawitzky & Zuccarello, 2003	Dasycladales	Polyphysaceae	2	-	-	x	-	-
Blidingia minima (Nägeli ex Kützing) Kylin, 1947	Ulvales	Kornmanniaceae	1	x	-	-	-	-
Blidingia Kylin, 1947	Ulvales	Kornmanniaceae	2	x	-	-	-	-
Ulva clathrata (Roth) C.Agardh, 1811	Ulvales	Ulvaceae	1	x	-	-	-	-
Ulva compressa Linnaeus, 1753	Ulvales	Ulvaceae	2	x	-	-	-	-
Ulva intestinalis Linnaeus, 1753	Ulvales	Ulvaceae	1	x	-	-	-	-
Ulva linza Linnaeus, 1753	Ulvales	Ulvaceae	1	x	-	-	-	-
Ulva rigida C.Agardh, 1823	Ulvales	Ulvaceae	3	x	-	-	-	-
Ulva torta (Mertens) Trevisan, 1842	Ulvales	Ulvaceae	1	x	-	-	-	-
Ulva Linnaeus, 1753	Ulvales	Ulvaceae	3	x	-	-	-	-
Ulvaceae J.V. Lamouroux ex Dumortier, 1822	Ulvales	Ulvaceae	1	x	-	-	-	-
Class Chlorophyceae								
Pseudotetraspora marina Wille, 1906	Chlamydomonadales	Palmellopsidaceae	1	-	-	x	-	-
Phyllum Rhodophyta								
Subphyllum Eurhodophytina								
Class Bangiophyceae								
Porphyra umbilicalis Kützing, 1843	Bangiales	Bangiaceae	1	x	-	-	-	-
Porphyra C.Agardh, 1824	Bangiales	Bangiaceae	1	x	-	-	-	-
Bangia atropurpurea (Mertens ex Roth) C.Agardh, 1824	Bangiales	Bangiaceae	1	x	-	-	-	-
Class Florideophyceae								
Asparagopsis armata f. rufolanosa Harvey, 1856	Bonnemaisoniales	Bonnemaisoniaceae	1	x	-	-	-	-
Asparagopsis armata Harvey, 1855	Bonnemaisoniales	Bonnemaisoniaceae	4	x	-	-	-	-

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Asparagopsis taxiformis (Delile) Trevisan de Saint-Léon, 1845	Bonnemaisoniales	Bonnemaisoniaceae	7	x	x	x	-	-
Asparagopsis Montagne, 1840	Bonnemaisoniales	Bonnemaisoniaceae	4	x	-	-	-	-
Ceramieales	Ceramiales		1	-	-	x	-	-
Chondracanthus teedei (Mertens ex Roth) Kützing, 1843	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Aglaothamnion Feldmann-Mazoyer, 1941	Ceramiales	Callithamniaceae	1	x	-	-	-	-
Callithamnion corymbosum (Smith) Lyngbye, 1819	Ceramiales	Callithamniaceae	1	x	-	-	-	-
Gaillona hookeri (Dillwyn) Athanasiadis, 2016	Ceramiales	Callithamniaceae	1	x	-	-	-	-
Spyridia filamentosa (Wulfen) Harvey, 1833	Ceramiales	Callithamniaceae	2	-	-	x	-	-
Spyridia hypnoides (Bory de Saint-Vincent) Papenfuss, 1968	Ceramiales	Callithamniaceae	1	-	-	x	-	-
Antithamnion Nägeli, 1847	Ceramiales	Ceramiaceae	1	x	-	-	-	-
Centroceras clavulatum (C.Agardh) Montagne, 1846	Ceramiales	Ceramiaceae	2	x	-	x	-	-
Ceramieae (Dumortier) Schmitz, 1889	Ceramiales	Ceramiaceae	1	x	-	-	-	-
Ceramium ciliatum (J.Ellis) Ducluzeau, 1806	Ceramiales	Ceramiaceae	2	x	-	-	-	-
Ceramium diaphanum (Lightfoot) Roth, 1806	Ceramiales	Ceramiaceae	2	x	-	x	-	-
Ceramium echionotum J.Agardh, 1844	Ceramiales	Ceramiaceae	2	x	-	-	-	-
Ceramium gaditanum (Clemente) Cremades, 1990	Ceramiales	Ceramiaceae	1	x	-	-	-	-
Ceramium virgatum Roth, 1797	Ceramiales	Ceramiaceae	2	x	-	-	-	-
Ceramium Roth, 1797	Ceramiales	Ceramiaceae	2	-	x	-	-	-
Gayliella mazoyerae T.O.Cho, Fredericq & Hommersand, 2008	Ceramiales	Ceramiaceae	1	-	-	x	-	-
Stirkia codii (H.Richards) Barros-Barreto & Maggs, 2023	Ceramiales	Ceramiaceae	1	-	-	x	-	-

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Acrosorium venulosum (Zanardini) Kylin, 1924	Ceramiales	Delesseriaceae	1	x	-	-	-	-
Acrosorium Zanardini ex Kützing, 1869	Ceramiales	Delesseriaceae	1	x	-	-	-	-
Cottoniella filamentosa (M.A.Howe) Børgesen, 1920	Ceramiales	Delesseriaceae	3	-	-	x	-	-
Dasya pedicellata (C.Agardh) C.Agardh, 1824	Ceramiales	Delesseriaceae	1	-	-	x	-	-
Dasya C.Agardh, 1824	Ceramiales	Delesseriaceae	1	x	-	-	-	-
Delesseriaceae Bory, 1828	Ceramiales	Delesseriaceae	1	x	-	-	-	-
Hypoglossum hypoglossoides (Stackhouse) Collins & Hervey, 1917	Ceramiales	Delesseriaceae	1	x	-	-	-	-
Chondria capillaris (Hudson) M.J.Wynne, 1991	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Chondria coerulescens (J.Agardh) Sauvageau, 1897	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Chondria dasyphylla (Woodward) C.Agardh, 1817	Ceramiales	Rhodomelaceae	2	x	-	x	-	-
Chondria C.Agardh, 1817	Ceramiales	Rhodomelaceae	1	-	x	-	-	-
Laurencia viridis Gil-Rodríguez & Haroun, 1992	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Laurencia J.V.Lamouroux, 1813	Ceramiales	Rhodomelaceae	5	x	-	x	-	-
Lophocladia trichoclados (C.Agardh) F.Schmitz, 1893	Ceramiales	Rhodomelaceae	2	-	-	x	-	-
Lophosiphonia Falkenberg, 1897	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Polysiphonia atlantica Kapraun & J.N.Norris, 1982	Ceramiales	Rhodomelaceae	2	x	-	x	-	-
Polysiphonia flexella (C.Agardh) J.Agardh, 1842	Ceramiales	Rhodomelaceae	1	-	-	x	-	-
Polysiphonia havanensis Montagne, 1837	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Polysiphonia opaca (C.Agardh) Moris & De Notaris, 1839	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Polysiphonia stricta (Mertens ex Dillwyn) Greville, 1824	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Polysiphonia Greville, 1823	Ceramiales	Rhodomelaceae	4	x	-	x	-	-

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Symphyocladia marchantioides (Harvey) Falkenberg, 1897	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Carradoriella denudata (Dillwyn) Savoie & G.W.Saunders, 2019	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Halopithys incurva (Hudson) Batters, 1902	Ceramiales	Rhodomelaceae	1	-	-	x	-	-
Herposiphonia secunda (C.Agardh) Ambronn, 1880	Ceramiales	Rhodomelaceae	1	-	-	x	-	-
Herposiphonia Nägeli, 1846	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Osmundea pinnatifida (Hudson) Stackhouse, 1809	Ceramiales	Rhodomelaceae	3	x	-	-	-	-
Osmundea Stackhouse, 1809	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Pterosiphonia Falkenberg, 1897	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Vertebrata fucoides (Hudson) Kuntze, 1891	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Vertebrata subulifera (C.Agardh) Kuntze, 1891	Ceramiales	Rhodomelaceae	1	-	-	x	-	-
Vertebrata tripinnata (Harvey) Kuntze, 1891	Ceramiales	Rhodomelaceae	1	x	-	-	-	-
Plumaria F.Schmitz, 1896	Ceramiales	Wrangeliaceae	1	x	-	-	-	x
Wrangelia penicillata (C.Agardh) C.Agardh, 1828	Ceramiales	Wrangeliaceae	1	-	-	x	-	-
Bornetia Thuret, 1855	Ceramiales	Wrangeliaceae	1	-	x	-	-	-
Articulated Corallinaceae	Corallinales		3	x	-	x	-	-
Rhodolith	Corallinales		4	x	-	x	-	-
Corallina officinalis Linnaeus, 1758	Corallinales	Corallinaceae	1	x	-	-	-	-
Corallina Linnaeus, 1758	Corallinales	Corallinaceae	3	x	-	-	-	-
Ellisolandia elongata (J.Ellis & Solander) K.R.Hind & G.W.Saunders, 2013	Corallinales	Corallinaceae	2	x	-	-	-	-
Jania adhaerens J.V.Lamouroux, 1816	Corallinales	Corallinaceae	2	x	-	x	-	-
Jania capillacea Harvey, 1853	Corallinales	Corallinaceae	1	x	-	-	-	-

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Jania longifurca Zanardini, 1844	Corallinales	Corallinaceae	2	x	-	-	-	-
Jania rubens (Linnaeus) J.V.Lamouroux, 1816	Corallinales	Corallinaceae	3	x	-	x	-	-
Jania virgata (Zanardini) Montagne, 1846	Corallinales	Corallinaceae	1	x	-	-	-	-
Jania J.V.Lamouroux, 1812	Corallinales	Corallinaceae	5	x	-	-	-	-
Lithophyllum crouaniorum Foslie, 1899	Corallinales	Lithophyllaceae	1	-	-	-	-	-
Lithophyllum hibernicum Foslie, 1906	Corallinales	Lithophyllaceae	1	-	-	-	-	-
Lithophyllum incrustans Philippi, 1837	Corallinales	Lithophyllaceae	4	-	x	x	-	-
Lithophyllum Philippi, 1837	Corallinales	Lithophyllaceae	1	-	x	-	-	-
Tenarea tortuosa (Esper) Me.Lemoine, 1910	Corallinales	Lithophyllaceae	2	x	-	-	-	-
Amphiroa J.V.Lamouroux, 1812	Corallinales	Lithophyllaceae	1	-	x	-	-	-
Neogoniolithon brassica-florida (Harvey) Setchell & L.R.Mason, 1943	Corallinales	Spongitidaceae	1	-	-	-	-	-
Gelidiella Feldmann & G.Hamel, 1934	Gelidiales	Gelidiellaceae	1	x	-	-	-	-
Gelidium microdon Kützing, 1849	Gelidiales	Gelidiellaceae	3	x	-	-	-	-
Gelidium pusillum (Stackhouse) Le Jolis, 1863	Gelidiales	Gelidiellaceae	2	x	-	-	-	-
Gelidium spinosum (S.G.Gmelin) P.C.Silva, 1996	Gelidiales	Gelidiellaceae	3	x	-	-	-	-
Millerella pannosa (Feldmann) G.H.Boo & L.Le Gall, 2016	Gelidiales	Gelidiellaceae	1	-	-	x	-	-
Pterocladiella capillacea (S.G.Gmelin) Santelices & Hommersand, 1997	Gelidiales	Pterocladiaceae	5	x	-	-	-	-
Catenella caespitosa (Withering) L.M.Irvine, 1976	Gigartinales	Caulacanthaceae	2	x	-	-	-	-
Caulacanthus ustulatus (Turner) Kützing, 1843	Gigartinales	Caulacanthaceae	1	x	-	-	-	-
Calliblepharis Kützing, 1843	Gigartinales	Cystocloniaceae	1	-	x	-	-	-
Hypnea musciformis (Wulfen) J.V.Lamouroux, 1813	Gigartinales	Cystocloniaceae	1	x	-	-	-	-

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Hypnea spinella (C.Agardh) Kützing, 1847	Gigartinales	Cystocloniaceae	1	-	-	x	-	-
Hypnea J.V.Lamouroux, 1813	Gigartinales	Cystocloniaceae	1	-	-	x	-	-
Dudresnaya P.L.Crouan & H.M.Crouan, 1835	Gigartinales	Dumontiaceae	1	-	x	-	-	-
Halarachnion ligulatum (Woodward) Kützing, 1843	Gigartinales	Furcellariaceae	1	-	-	x	-	-
Chondracanthus acicularis (Roth) Fredericq, 1993	Gigartinales	Gigartinaceae	3	x	-	-	-	-
Gigartina pistillata (S.G.Gmelin) Stackhouse, 1809	Gigartinales	Gigartinaceae	1	x	-	-	-	-
Callophyllis Kützing, 1843	Gigartinales	Kallymeniaceae	1	-	x	-	-	-
Kallymenia reniformis (Turner) J.Agardh, 1842	Gigartinales	Kallymeniaceae	1	-	x	-	-	-
Erythrodermis traillii (Holmes ex Batters) Guiry & Garbary, 1990	Gigartinales	Phyllophoraceae	1	x	-	-	-	-
Gymnogongrus griffithsiae (Turner) C.Martius, 1833	Gigartinales	Phyllophoraceae	1	x	-	-	-	-
Phyllophora gelidioides P.L.Crouan & H.M.Crouan ex Karsakoff, 1896	Gigartinales	Phyllophoraceae	1	x	-	-	-	-
Sphaerococcus coronopifolius Stackhouse, 1797	Gigartinales	Sphaerococcaceae	2	x	-	-	-	-
Gracilaria Greville, 1830	Gracilariales	Gracilariaceae	2	-	x	x	-	-
Dermocorynus dichotomus (J.Agardh) Gargiulo, M.Morabito & Manghisi, 2013	Halymeniales	Grateloupiaceae	1	x	-	-	-	-
Lithothamnion corallioides (P.Crouan & H.Crouan) P.Crouan & H.Crouan, 1867	Hapalidiales	Hapalidiaceae	3	-	-	x	-	-
Lithothamnion Heydrich, 1897	Hapalidiales	Hapalidiaceae	1	-	x	-	-	-
Phymatolithon calcareum (Pallas) W.H.Adey & D.L.McKibbin ex Woelkering & L.M.Irvine, 1986	Hapalidiales	Hapalidiaceae	3	-	-	x	-	-
Phymatolithon lusitanicum V.Peña, 2015	Hapalidiales	Hapalidiaceae	1	-	-	-	-	-
Phymatolithon Foslie, 1898	Hapalidiales	Hapalidiaceae	1	-	x	-	-	-
Mesophyllum lichenoides (J.Ellis) Me.Lemoine, 1928	Hapalidiales	Mesophyllumaceae	1	x	-	-	-	-

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Mesophyllum sphaericum V.Pena, Bárbara, W.H.Adey, Riosmena-Rodrigues & H.G.Choi, 2011	Hapalidiales	Mesophyllumaceae	1	-	-	-	-	-
Mesophyllum Me.Lemoine, 1928	Hapalidiales	Mesophyllumaceae	1	-	x	-	-	-
Hildenbrandia rubra (Sommerfelt) Meneghini, 1841	Hildenbrandiales	Hildenbrandiaceae	1	x	-	-	-	-
Hildenbrandia Nardo, 1834	Hildenbrandiales	Hildenbrandiaceae	4	x	-	-	-	-
Liagora J.V.Lamouroux, 1812	Nemaliales	Liagoraceae	1	-	x	-	-	-
Nemalion elminthoides (Velley) Batters, 1902	Nemaliales	Nemaliaceae	1	x	-	-	-	-
Scinaia Bivona-Bernardi, 1822	Nemaliales	Scinaiaceae	1	-	-	x	-	-
Platoma Schousboe ex F.Schmitz, 1894	Nemastomatales	Schizymeniaceae	1	x	-	-	-	-
Schizymenia dubyi (Chauvin ex Duby) J.Agardh, 1851	Nemastomatales	Schizymeniaceae	1	x	-	-	-	-
Palmaria palmata (Linnaeus) F.Weber & D.Mohr, 1805	Palmariales	Palmariaceae	1	x	-	-	-	-
Peyssonnelia rubra (Greville) J.Agardh, 1851	Peyssonneliales	Peyssonneliaceae	1	x	-	-	-	-
Peyssonnelia Decaisne, 1841	Peyssonneliales	Peyssonneliaceae	4	x	-	x	-	-
Plocamium cartilagineum (Linnaeus) P.S.Dixon, 1967	Plocamiales	Plocamiaceae	2	x	-	-	-	-
Champia parvula (C.Agardh) Harvey, 1853	Rhodymeniales	Champiaceae	1	-	-	x	-	-
Champia Desvaux, 1809	Rhodymeniales	Champiaceae	1	-	x	-	-	-
Gastroclonium ovatum (Hudson) Papenfuss, 1944	Rhodymeniales	Champiaceae	1	x	-	-	-	-
Gastroclonium reflexum (Chauvin) Kützing, 1849	Rhodymeniales	Champiaceae	1	x	-	-	-	-
Lomentaria articulata (Hudson) Lyngbye, 1819	Rhodymeniales	Lomentariaceae	2	x	-	-	-	-
Rhodymenia holmesii Ardissone, 1893	Rhodymeniales	Rhodymeniaceae	2	x	-	-	-	-
Rhodymenia pseudopalmata (J.V.Lamouroux) P.C.Silva, 1952	Rhodymeniales	Rhodymeniaceae	1	x	-	-	-	-
Phyllum Ochrophyta								

Class Dictyochophyceae								
Padina pavonica (Linnaeus) Thivy, 1960	Dictyochales	Dictyochaceae	10	x	-	x	-	-
Padina Adanson, 1763	Dictyochales	Dictyochaceae	1	-	-	x	-	-
Class Phaeophyceae								
Lobophora variegata (J.V.Lamouroux) Womersley ex E.C.Oliveira, 1977	Dictyotales	Dictyotaceae	4	-	-	x	-	-
Lobophora J.Agardh, 1894	Dictyotales	Dictyotaceae	4	-	x	x	-	-
Stypopodium zonale (J.V.Lamouroux) Papenfuss, 1940	Dictyotales	Dictyotaceae	1	-	x	-	-	-
Canistrocarpus cervicornis (Kützing) De Paula & De Clerck, 2006	Dictyotales	Dictyotaceae	1	-	-	x	-	-
Dictyopteris polypodioides (A.P.De Candolle) J.V.Lamouroux, 1809	Dictyotales	Dictyotaceae	1	x	-	-	-	-
Dictyota bartayresiana J.V.Lamouroux, 1809	Dictyotales	Dictyotaceae	1	x	-	-	-	-
Dictyota dichotoma (Hudson) J.V.Lamouroux, 1809	Dictyotales	Dictyotaceae	5	x	-	x	-	-
Dictyota fasciola (Roth) J.V.Lamouroux, 1809	Dictyotales	Dictyotaceae	1	-	-	x	-	-
Dictyota J.V.Lamouroux, 1809	Dictyotales	Dictyotaceae	12	x	-	x	-	-
Zonaria tournefortii (J.V.Lamouroux) Montagne, 1846	Dictyotales	Dictyotaceae	6	x	-	-	-	-
Leathesia marina (Lyngbye) Decaisne, 1842	Ectocarpales	Chordariaceae	1	x	-	-	-	-
Hydroclathrus clathratus (C.Agardh) M.Howe, 1920	Ectocarpales	Scytosiphonaceae	3	x	-	x	-	-
Colpomenia sinuosa (Mertens ex Roth) Derbès & Solier, 1851	Ectocarpales	Scytosiphonaceae	5	x	-	x	-	-
Petalonia binghamiae (J.Agardh) K.L.Vinogradova, 1973	Ectocarpales	Scytosiphonaceae	1	x	-	-	-	-
Fucus spiralis Linnaeus, 1753	Fucales	Fucaceae	3	x	-	-	-	-
Gongolaria abies-marina (S.G.Gmelin) Kuntze 1891	Fucales	Sargassaceae	2	x	-	x	-	-
Sargassum furcatum Kützing, 1843	Fucales	Sargassaceae	1	-	-	x	-	-
Sargassum C.Agardh, 1820	Fucales	Sargassaceae	4	x	-	x	-	-

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Cystoseira C.Agardh, 1820	Fucales	Sargassaceae	2	x	-	-	-	-
Ericaria selaginoides (Linnaeus) Molinari & Guiry, 2020	Fucales	Sargassaceae	1	x	-	-	-	-
Treptacantha abies-marina (S.G.Gmelin) Kützing, 1843	Fucales	Sargassaceae	4	x	-	x	-	-
Laminaria ochroleuca Bachelot de la Pylaie, 1824	Laminariales	Laminariaceae	4	x	-	x	-	x
Nemoderma tingitanum Schousboe ex Bornet, 1892	Nemodermatales	Nemodermataceae	2	x	-	-	-	-
Nemoderma Schousboe ex Bornet, 1892	Nemodermatales	Nemodermataceae	1	-	x	-	-	-
Ralfsia Berkeley, 1843	Ralfsiales	Ralfsiaceae	1	x	-	-	-	-
Cladostephus spongiosus (Hudson) C.Agardh, 1817	Sphacelariales	Cladostephaceae	1	x	-	-	-	-
Sphacelaria Lyngbye, 1818	Sphacelariales	Sphacelariaceae	1	x	-	-	-	-
Halopteris filicina (Grateloup) Kützing, 1843	Sphacelariales	Stypocaulaceae	9	x	-	x	-	-
Halopteris scoparia (Linnaeus) Sauvageau, 1904	Sphacelariales	Stypocaulaceae	5	x	-	x	-	-
Halopteris Kützing, 1843	Sphacelariales	Stypocaulaceae	3	x	x	-	-	-
Sporochnus pedunculatus (Hudson) C.Agardh, 1817	Sporochnales	Sporochnaceae	2	-	x	-	-	-
Carpomitra costata (Stackhouse) Batters, 1902	Sporochnales	Sporochnaceae	1	x	-	-	-	-
Cutleria multifida (Turner) Greville, 1830	Tilopteridales	Cutleriaceae	1	x	-	-	-	-
Phyllariopsis brevipes (C.Agardh) E.C.Henry & G.R.South, 1987	Tilopteridales	Phyllariaceae	1	x	-	-	-	-
Phyllum Tracheophyta								
Subphyllum Spermatophytina								
Class Magnoliopsida								
Alismatales	Alismatales		1	-	-	x	-	-
Cymodocea nodosa (Ucria) Ascherson, 1870	Alismatales	Cymodoceaceae	14	-	x	x	-	-
Halodule wrightii Ascherson, 1868	Alismatales	Cymodoceaceae	1	-	-	-	x	-

Halophila decipiens Ostenfeld, 1902	Alismatales	Hydrocharitaceae	1	-	-	**x**	-	-
Ruppia maritima Linnaeus, 1753	Alismatales	Ruppiaceae	1	-	-	-	x	-

References

1. Otero-Ferrer, F.; Tuya, F.; Bosch Guerra, N.E.; Herrero-Barrencua, A.; Abreu, A.D.; Haroun, R. Composition, Structure and Diversity of Fish Assemblages across Seascape Types at Príncipe, an Understudied Tropical Island in the Gulf of Guinea (Eastern Atlantic Ocean). *Afr J Mar Sci* **2020**, *42*, 381–391, doi:10.2989/1814232X.2020.1826358.
2. Tuya, F.; Vanderklift, M.A.; Hyndes, G.A.; Wernberg, T.; Thomsen, M.S.; Hanson, C. Proximity to Rocky Reefs Alters the Balance between Positive and Negative Effects on Seagrass Fauna. *Mar Ecol Prog Ser* **2010**, *405*, 175–186.
3. Cosme De Esteban, M.; Haroun, R.; Tuya, F.; Abreu, A.D.; Otero-Ferrer, F. Mapping Marine Habitats in the Gulf of Guinea: A Contribution to the Future Establishment of Marine Protected Areas in Principe Island. *Reg Stud Mar Sci* **2023**, *57*, 102742, doi:10.1016/j.rsma.2022.102742.
4. Casas, E.; Fernandez, M.; Gil, A.; Yesson, C.; Prestes, A.; Moreu-Badia, I.; Neto, A.; Arbelo, M. Macroalgae Niche Modelling: A Two-Step Approach Using Remote Sensing and in Situ Observations of a Native and an Invasive Asparagopsis. *Biol Invasions* **2021**, *23*, 3215–3230, doi:10.1007/s10530-021-02554-z.
5. Filbee-Dexter, K.; Wernberg, T.; Barreiro, R.; Coleman, M.A.; Bettignies, T.; Feehan, C.J.; Franco, J.N.; Hasler, B.; Louro, I.; Norderhaug, K.M.; et al. Leveraging the Blue Economy to Transform Marine Forest Restoration. *J Phycol* **2022**, *58*, 198–207, doi:10.1111/jpy.13239.
6. Schubert, N.; Peña, V.; Salazar, V.W.; Horta, P.A.; Neves, P.; Ribeiro, C.; Otero-Ferrer, F.; Tuya, F.; Espino, F.; Schoenrock, K.; et al. Rhodolith Physiology Across the Atlantic: Towards a Better Mechanistic Understanding of Intra- and Interspecific Differences. *Front Mar Sci* **2022**, *9*, doi:10.3389/fmars.2022.921639.
7. Buhl-Mortensen, P.; Buhl-Mortensen, L.; Purser, A. Trophic Ecology and Habitat Provision in Cold-Water Coral Ecosystems. In *Marine Animal Forests*; Springer International Publishing: Cham, 2016; pp. 1–26.
8. Govenar, B.; Fisher, C.R. Experimental Evidence of Habitat Provision by Aggregations of Riftia Pachyptila at Hydrothermal Vents on the East Pacific Rise. *The Authors. Journal compilation* [a] **2007**, *28*, 3–14, doi:10.1111/j.1439-0485.2006.00148.x.
9. Graham, L.; Gaulton, R.; Gerard, F.; Staley, J.T. The Influence of Hedgerow Structural Condition on Wildlife Habitat Provision in Farmed Landscapes. *Biol Conserv* **2018**, *220*, 122–131, doi:10.1016/j.biocon.2018.02.017.
10. Nielsen, P.; Nielsen, M.M.; McLaverty, C.; Kristensen, K.; Geitner, K.; Olsen, J.; Saurel, C.; Petersen, J.K. Management of Bivalve Fisheries in Marine Protected Areas. *Mar Policy* **2021**, *124*, doi:10.1016/j.marpol.2020.104357.
11. Andrews, N.; Bennett, N.J.; Le Billon, P.; Green, S.J.; Cisneros-Montemayor, A.M.; Amongin, S.; Gray, N.J.; Sumaila, U.R. Oil, Fisheries and Coastal Communities: A Review of Impacts on the Environment, Livelihoods, Space and Governance. *Energy Res Soc Sci* 2021, *75*.
12. Breen, C.; El Safadi, C.; Huigens, H.; Tews, S.; Westley, K.; Anderou, G.; Vazquez, R.O.; Nikolaus, J.; Blue, L. Integrating Cultural and Natural Heritage Approaches to Marine Protected Areas in the MENA Region. *Mar Policy* **2021**, *132*, doi:10.1016/j.marpol.2021.104676.
13. Hattam, C.; Broszeit, S.; Langmead, O.; Praptiwi, R.A.; Lim, V.C.; Creencia, L.A.; Tran, D.H.; Maharja, C.; Mitra Setia, T.; Wulandari, P.; et al. A Matrix Approach to Tropical Marine Ecosystem Service Assessments in South East Asia. *Ecosyst Serv* **2021**, *51*, doi:10.1016/j.ecoser.2021.101346.
14. Otero-Ferrer, F.; Cosme, M.; Tuya, F.; Espino, F.; Haroun, R. Effect of Depth and Seasonality on the Functioning of Rhodolith Seabeds. *Estuar Coast Shelf Sci* **2020**, *235*, 106579, doi:10.1016/j.ecss.2019.106579.
15. Otero-Ferrer, F.; Mannarà, E.; Cosme De Esteban, M.; Falace, A.; Montiel-Nelson, J.A.; Espino, F.; Haroun, R.; Tuya, F. Early-Faunal Colonization Patterns of Discrete Habitat Units: A Case Study with Rhodolith-Associated Vagile Macrofauna. *Estuar Coast Shelf Sci* **2019**, *218*, 9–22, doi:10.1016/j.ecss.2018.11.020.

16. Perez-Peris, I.; Navarro-Mayoral, S.; de Esteban, M.C.; Tuya, F.; Pena, V.; Barbara, I.; Neves, P.; Ribeiro, C.; Abreu, A.; Grall, J.; et al. Effect of Depth across a Latitudinal Gradient in the Structure of Rhodolith Seabeds and Associated Biota across the Eastern Atlantic Ocean. *DIVERSITY-BASEL* **2023**, *15*, doi:10.3390/d15010103.
17. Jones, C.G.; Lawton, J.H.; Shachak, M. Organisms as Ecosystem Engineers. *Oikos* **1994**, *69*, 373, doi:10.2307/3545850.
18. Ferreiro, N.; Feijoó, C.; Giorgi, A.; Rosso, J. Macroinvertebrates Select Complex Macrophytes Independently of Their Body Size and Fish Predation Risk in a Pampean Stream. *Hydrobiologia* **2014**, *740*, 191–205, doi:10.1007/s10750-014-1953-y.
19. Cúrdia, J.; Carvalho, S.; Pereira, F.; Guerra-García, J.M.; Santos, M.N.; Cunha, M.R. Diversity and Abundance of Invertebrate Epifaunal Assemblages Associated with Gorgonians Are Driven by Colony Attributes. *Coral Reefs* **2015**, *34*, 611–624, doi:10.1007/s00338-015-1283-1.
20. Cacabelos, E.; Martins, G.M.; Thompson, R.; Prestes, A.C.L.; Azevedo, J.M.N.; Neto, A.I. Material Type and Roughness Influence Structure of Inter-tidal Communities on Coastal Defenses. *Marine Ecology* **2016**, *37*, 801–812, doi:10.1111/maec.12354.
21. Carvalho, L.R.S.; Loiola, M.; Barros, F. Manipulating Habitat Complexity to Understand Its Influence on Benthic Macrofauna. *J Exp Mar Biol Ecol* **2017**, *489*, 48–57, doi:10.1016/j.jembe.2017.01.014.
22. Matias, M.G.; Underwood, A.J.; Hochuli, D.F.; Coleman, R.A. Independent Effects of Patch Size and Structural Complexity on Diversity of Benthic Macroinvertebrates. *Ecology* **2010**, *91*, 1908–1915, doi:10.1890/09-1083.1.
23. Pianka, E.R. *Evolutionary Ecology*; 6th ed.; Benjamin Cummings: San Francisco, California, USA, 2000;
24. Yanovski, R.; Nelson, P.A.; Abelson, A. Structural Complexity in Coral Reefs: Examination of a Novel Evaluation Tool on Different Spatial Scales. *Front Ecol Evol* **2017**, *5*, 27, doi:10.3389/fevo.2017.00027.
25. Trégarot, E.; D'Olivo, J.P.; Botelho, A.Z.; Cabrito, A.; Cardoso, G.O.; Casal, G.; Cornet, C.C.; Cragg, S.M.; Degia, A.K.; Fredriksen, S.; et al. Effects of Climate Change on Marine Coastal Ecosystems – A Review to Guide Research and Management. *Biol Conserv* **2024**, *289*, 110394, doi:10.1016/j.biocon.2023.110394.
26. Gundersen, H. (NIVA); Bryan, T. (GRID-A.; Chen, W. (NIVA); Moy, F.E. (IMR); Sandman, A.N. (AquaBiota); Sundblad, G. (AquaBiota); Schneider, S. (NIVA); Andersen, J.H. (NIVA); Langaas, S. (NIVA); Walday, M.G. (NIVA) *Ecosystem Services*; Nordic Council of Ministers, 2017; ISBN 978-9-28934-7-488.
27. Hemminga, M.A.; Duarte, C.M. *Seagrass Ecology*; Cambridge University Press, 2000; ISBN 9780521661843.
28. Boström, C.; Baden, S.; Bockelmann, A.; Dromph, K.; Fredriksen, S.; Gustafsson, C.; Krause-Jensen, D.; Möller, T.; Nielsen, S.L.; Olesen, B.; et al. Distribution, Structure and Function of Nordic Eelgrass (Zostera Marina) Ecosystems: Implications for Coastal Management and Conservation. *Aquat Conserv* **2014**, *24*, 410–434, doi:10.1002/aqc.2424.
29. Jahnke, M.; Christensen, A.; Micu, D.; Milchakova, N.; Sezgin, M.; Todorova, V.; Strungaru, S.; Procaccini, G. Patterns and Mechanisms of Dispersal in a Keystone Seagrass Species. *Mar Environ Res* **2016**, *117*, 54–62, doi:10.1016/j.marenvres.2016.04.004.
30. Bekkby, T.; Papadopoulou, N.; Fiorentino, D.; McOwen, C.J.; Rinde, E.; Boström, C.; Carreiro-Silva, M.; Linares, C.; Andersen, G.S.; Bengil, E.G.T.; et al. Habitat Features and Their Influence on the Restoration Potential of Marine Habitats in Europe. *Front Mar Sci* **2020**, *7*, 184, doi:10.3389/fmars.2020.00184.
31. Smale, D.A.; Burrows, M.T.; Moore, P.; O'Connor, N.; Hawkins, S.J. Threats and Knowledge Gaps for Ecosystem Services Provided by Kelp Forests: A Northeast Atlantic Perspective. *Ecol Evol* **2013**, *3*, 4016–4038, doi:10.1002/ece3.774.
32. Filbee-Dexter, K.; Wernberg, T. Rise of Turfs: A New Battlefront for Globally Declining Kelp Forests. *Bioscience* **2018**, *68*, 64–76, doi:10.1093/biosci/bix147.
33. Steller, D.L.; Riosmena-Rodríguez, R.; Foster, M.S.; Roberts, C.A. Rhodolith Bed Diversity in the Gulf of California: The Importance of Rhodolith Structure and Consequences of Disturbance. *Aquat Conserv* **2003**, *13*, 5–20, doi:10.1002/aqc.564.
34. Thomsen, M.S.; Wernberg, T.; Altieri, A.; Tuya, F.; Gulbransen, D.; Mcglathery, K.J.; Holmer, M.; Silliman, B.R. Habitat Cascades: The Conceptual Context and Global Relevance of Facilitation Cascades via Habitat Formation and Modification. *Integr Comp Biol* **2010**, *50*, 158–175, doi:10.1093/icb/icq042.

 doi:10.20944/preprints202504.2568.v1

35. de Figueiredo, M.A.O.; Santos de Menezes, K.; Costa-Paiva, E.M.; Paiva, P.C.; Ventura, C.R.R. Evaluacion Experimental de Rodolitos Como Sustratos Vivos Para La Infauna En El Banco de Abrolhos, Brasil. *Cienc Mar* **2007**, *33*, 427–440.
36. Nordlund, L.M.; Unsworth, R.K.F.; Wallner-Hahn, S.; Ratnarajah, L.; Beca-Carretero, P.; Boikova, E.; Bull, J.C.; Chefaoui, R.M.; de los Santos, C.B.; Gagnon, K.; et al. One Hundred Priority Questions for Advancing Seagrass Conservation in Europe. *PLANTS, PEOPLE, PLANET* **2024**, *6*, 587–603, doi:10.1002/ppp3.10486.
37. Mtwana Nordlund, L.; Koch, E.W.; Barbier, E.B.; Creed, J.C. Seagrass Ecosystem Services and Their Variability across Genera and Geographical Regions. *PLoS One* **2016**, *11*, e0163091, doi:10.1371/journal.pone.0163091.
38. Campagne, C.S.; Salles, J.-M.; Boissery, P.; Deter, J. The Seagrass Posidonia Oceanica : Ecosystem Services Identification and Economic Evaluation of Goods and Benefits. *Mar Pollut Bull* **2015**, *97*, 391–400, doi:10.1016/j.marpolbul.2015.05.061.
39. Roberts, C.; Ormond, R. Habitat Complexity and Coral Reef Fish Diversity and Abundance on Red Sea Fringing Reefs. *Mar Ecol Prog Ser* **1987**, *41*, 1–8, doi:10.3354/meps041001.
40. Roberts, J.M.; Wheeler, A.; Freiwald, A.; Cairns, S. *Cold-Water Corals: The Biology and Geology of Deep-Sea Coral Habitats*; Cambridge University Press, 2009; ISBN 9780521884853.
41. Berke, S.K. Functional Groups of Ecosystem Engineers: A Proposed Classification with Comments on Current Issues. *Integr Comp Biol* **2010**, *50*, 147–157, doi:10.1093/icb/icq077.
42. Tissot, B.N.; Yoklavich, M.M.; Love, M.S.; York, K.; Amend, M. Benthic Invertebrates That Form Habitat on Deep Banks off Southern California, with Special Reference to Deep Sea Coral. *Fishery Bulletin* **2006**, *104*, 167–181.
43. Herler, J. Microhabitats and Ecomorphology of Coral- and Coral Rock-Associated Gobiid Fish (Teleostei: Gobiidae) in the Northern Red Sea. *Marine Ecology* **2007**, *28*, 82–94, doi:10.1111/j.1439-0485.2007.00165.x.
44. Cosme De Esteban, M.; Otero Ferrer, F.; Haroun, R. Los Fondos de Rodolitos: El Valor Oculto de Los Ecosistemas Marinos. *Okeanos* **2020**, *10*, 26–35.
45. Buhl-Mortensen, L.; Buhl-Mortensen, P.; Dolan, M.J.F.; Gonzalez-Mirelis, G. Habitat Mapping as a Tool for Conservation and Sustainable Use of Marine Resources: Some Perspectives from the MAREANO Programme, Norway. *J Sea Res* **2015**, *100*, 46–61, doi:10.1016/j.seares.2014.10.014.
46. Czechowska, K.; Feldens, P.; Tuya, F.; Cosme de Esteban, M.; Espino, F.; Haroun, R.; Schönke, M.; Otero-Ferrer, F. Testing Side-Scan Sonar and Multibeam Echosounder to Study Black Coral Gardens: A Case Study from Macaronesia. *Remote Sens (Basel)* **2020**, *12*, 3244, doi:10.3390/rs12193244.
47. Kaiser, M.J.; Hilborn, R.; Jennings, S.; Amaroso, R.; Andersen, M.; Balliet, K.; Barratt, E.; Bergstad, O.A.; Bishop, S.; Bostrom, J.L.; et al. Prioritization of Knowledge-Needs to Achieve Best Practices for Bottom Trawling in Relation to Seabed Habitats. *Fish and Fisheries* **2016**, *17*, 637–663, doi:10.1111/faf.12134.
48. van der Reijden, K.J.; Govers, L.L.; Koop, L.; Damveld, J.H.; Herman, P.M.J.; Mestdagh, S.; Piet, G.; Rijnsdorp, A.D.; Dinesen, G.E.; Snellen, M.; et al. Beyond Connecting the Dots: A Multi-Scale, Multi-Resolution Approach to Marine Habitat Mapping. *Ecol Indic* **2021**, *128*, 107849, doi:10.1016/j.ecolind.2021.107849.
49. Leslie, H.M.; McLeod, K.L. Confronting the Challenges of Implementing Marine Ecosystem-Based Management. *Front Ecol Environ* **2007**, *5*, 540–548, doi:10.1890/060093.
50. Baldwin, K.; Oxenford, H.A. A Participatory Approach to Marine Habitat Mapping in the Grenadine Islands. *Coastal Management* **2014**, *42*, 36–58, doi:10.1080/08920753.2013.863725.
51. Cogan, C.B.; Todd, B.J.; Lawton, P.; Noji, T.T. The Role of Marine Habitat Mapping in Ecosystem-Based Management. *ICES Journal of Marine Science* **2009**, *66*, 2033–2042, doi:10.1093/icesjms/fsp214.
52. de Young, C.; Charles, A.; Hjort, A. Human Dimensions of the Ecosystem Approach to Fisheries: An Overview of Context, Concepts, Tools and Methods. *FAO Fisheries Technical Paper* 2008, *489*, 152.
53. Tallis, H.; Levin, P.S.; Ruckelshaus, M.; Lester, S.E.; McLeod, K.L.; Fluharty, D.L.; Halpern, B.S. The Many Faces of Ecosystem-Based Management: Making the Process Work Today in Real Places. *Mar Policy* **2010**, *34*, 340–348, doi:10.1016/j.marpol.2009.08.003.
54. Christie, P.; White, A.T. Best Practices for Improved Governance of Coral Reef Marine Protected Areas. *Coral Reefs* **2007**, *26*, 1047–1056, doi:10.1007/s00338-007-0235-9.

 doi:10.20944/preprints202504.2568.v1

55. Katsanevakis, S.; Stelzenmüller, V.; South, A.; Sørensen, T.K.; Jones, P.J.S.; Kerr, S.; Badalamenti, F.; Anagnostou, C.; Breen, P.; Chust, G.; et al. Ecosystem-Based Marine Spatial Management: Review of Concepts, Policies, Tools, and Critical Issues. *Ocean Coast Manag* **2011**, *54*, 807–820, doi:10.1016/j.ocecoaman.2011.09.002.
56. Cosme De Esteban, M.; Feldens, P.; Haroun, R.; Tuya, F.; Gil, A.; Otero Ferrer, F. Habitat Mapping of the Vila Franca Do Campo Marine Reserve (Azores) and Recommendations for Its Improvement. *Estuar Coast Shelf Sci* **2024**, *303*, 108809, doi:10.1016/j.ecss.2024.108809.
57. Floor, J.R.; van Koppen, C.S.A. (Kris); van Tatenhove, J.P.M. Science, Uncertainty and Changing Storylines in Nature Restoration: The Case of Seagrass Restoration in the Dutch Wadden Sea. *Ocean Coast Manag* **2018**, *157*, 227–236, doi:10.1016/j.ocecoaman.2018.02.016.
58. Balado, J.; Olabarria, C.; Martínez-Sánchez, J.; Rodríguez-Pérez, J.R.; Pedro, A. Semantic Segmentation of Major Macroalgae in Coastal Environments Using High-Resolution Ground Imagery and Deep Learning. *Int J Remote Sens* **2021**, *42*, 1785–1800, doi:10.1080/01431161.2020.1842543.
59. Bell, J.J.; Micaroni, V.; Harris, B.; Strano, F.; Broadribb, M.; Rogers, A. Global Status, Impacts, and Management of Rocky Temperate Mesophotic Ecosystems. *Conservation Biology* **2024**, *38*, doi:10.1111/cobi.13945.
60. de la Mare, W.K. Marine Ecosystem-Based Management as a Hierarchical Control System. *Mar Policy* **2005**, *29*, 57–68, doi:10.1016/j.marpol.2004.02.002.
61. Sini, M.; Katsanevakis, S.; Koukourouvli, N.; Gerovasileiou, V.; Dailianis, T.; Buhl-Mortensen, L.; Damalas, D.; Dendrinos, P.; Dimas, X.; Frantzis, A.; et al. Assembling Ecological Pieces to Reconstruct the Conservation Puzzle of the Aegean Sea. *Front Mar Sci* **2017**, *4*, doi:10.3389/fmars.2017.00347.
62. Mumby, P.J.; Green, E.P.; Edwards, A.J.; Clark, C.D. The Cost-Effectiveness of Remote Sensing for Tropical Coastal Resources Assessment and Management. *J Environ Manage* **1999**, *55*, 157–166, doi:10.1006/jema.1998.0255.
63. Harris, P.; Baker, E. (eds) *Seafloor Geomorphology as Benthic Habitat*; Elsevier: Amsterdam, The Netherlands, 2020; ISBN 9780128149607.
64. Jordan, A.; Lawler, M.; Halley, V.; Barrett, N. Seabed Habitat Mapping in the Kent Group of Islands and Its Role in Marine Protected Prea Planning. *Aquat Conserv* **2005**, *15*, 51–70, doi:10.1002/aqc.657.
65. Che Hasan, R.; Ierodiaconou, D.; Laurenson, L. Combining Angular Response Classification and Backscatter Imagery Segmentation for Benthic Biological Habitat Mapping. *Estuar Coast Shelf Sci* **2012**, *97*, 1–9, doi:10.1016/j.ecss.2011.10.004.
66. Li, D.; Tang, C.; Xia, C.; Zhang, H. Acoustic Mapping and Classification of Benthic Habitat Using Unsupervised Learning in Artificial Reef Water. *Estuar Coast Shelf Sci* **2017**, *185*, 11–21, doi:10.1016/j.ecss.2016.12.001.
67. Roff, J.C.; Taylor, M.E.; Laughren, J. Geophysical Approaches to the Classification, Delineation and Monitoring of Marine Habitats and Their Communities. *Aquat Conserv* **2003**, *13*, 77–90, doi:10.1002/aqc.525.
68. Stelzenmüller, V.; Breen, P.; Stamford, T.; Thomsen, F.; Badalamenti, F.; Borja, Á.; Buhl-Mortensen, L.; Carlstöm, J.; D'Anna, G.; Dankers, N.; et al. Monitoring and Evaluation of Spatially Managed Areas: A Generic Framework for Implementation of Ecosystem Based Marine Management and Its Application. *Mar Policy* **2013**, *37*, 149–164, doi:10.1016/j.marpol.2012.04.012.
69. Moura, R.L.; Secchin, N.A.; Amado-Filho, G.M.; Francini-Filho, R.B.; Freitas, M.O.; Minte-Vera, C.V.; Teixeira, J.B.; Thompson, F.L.; Dutra, G.F.; Sumida, P.Y.G.; et al. Spatial Patterns of Benthic Megahabitats and Conservation Planning in the Abrolhos Bank. *Cont Shelf Res* **2013**, *70*, 109–117, doi:10.1016/j.csr.2013.04.036.
70. Brown, C.J.; Collier, J.S. Mapping Benthic Habitat in Regions of Gradational Substrata: An Automated Approach Utilising Geophysical, Geological, and Biological Relationships. *Estuar Coast Shelf Sci* **2008**, *78*, 203–214, doi:10.1016/j.ecss.2007.11.026.
71. Li, R.; Liu, J.-K.; Sukcharoenpong, A.; Yuan, J.; Zhu, H.; Zhang, S. A Systematic Approach toward Detection of Seagrass Patches from Hyperspectral Imagery. *Marine Geodesy* **2012**, *35*, 271–286, doi:10.1080/01490419.2012.699019.

72. Micallef, A.; Le Bas, T.P.; Huvenne, V.A.I.; Blondel, P.; Hühnerbach, V.; Deidun, A. A Multi-Method Approach for Benthic Habitat Mapping of Shallow Coastal Areas with High-Resolution Multibeam Data. *Cont Shelf Res* **2012**, *39–40*, 14–26, doi:10.1016/j.csr.2012.03.008.
73. Lurton, X. *An Introduction to Underwater Acoustics: Principles and Applications*; 2nd ed.; Springer/Praxis Publishing: Berlin, Germany, 2010;
74. Brock, J.C.; Purkis, S.J. The Emerging Role of Lidar Remote Sensing in Coastal Research and Resource Management. *J Coast Res* **2009**, *53*, 1–5, doi:10.2112/SI53-001.1.
75. Lafon, V.; Froidefond, J.M.; Lahet, F.; Castaing, P. SPOT Shallow Water Bathymetry of a Moderately Turbid Tidal Inlet Based on Field Measurements. *Remote Sens Environ* **2002**, *81*, 136–148, doi:10.1016/S0034-4257(01)00340-6.
76. Lecours, V.; Dolan, M.F.J.; Micallef, A.; Lucieer, V.L. Characterising the Ocean Frontier: A Review of Marine and Coastal Geomorphometry. *Hydrol Earth Syst Sci* **2016**, 1–66, doi:10.5194/hess-2016-73.
77. Su, H.; Liu, H.; Wang, L.; Filippi, A.M.; Heyman, W.D.; Beck, R.A. Geographically Adaptive Inversion Model for Improving Bathymetric Retrieval From Satellite Multispectral Imagery. *IEEE Transactions on Geoscience and Remote Sensing* **2014**, *52*, 465–476, doi:10.1109/TGRS.2013.2241772.
78. Wang, C.-K.; Philpot, W.D. Using Airborne Bathymetric Lidar to Detect Bottom Type Variation in Shallow Waters. *Remote Sens Environ* **2007**, *106*, 123–135, doi:10.1016/j.rse.2006.08.003.
79. Agardy, T.; Bridgewater, P.; Crosby, M.P.; Day, J.; Dayton, P.K.; Kenchington, R.; Laffoley, D.; McConney, P.; Murray, P.A.; Parks, J.E.; et al. Dangerous Targets? Unresolved Issues and Ideological Clashes around Marine Protected Areas. *Aquat Conserv* **2003**, *13*, 353–367, doi:10.1002/aqc.583.
80. Spalding, M.D.; Fox, H.E.; Allen, G.R.; Davison, N.; Ferdaña, Z.A.; Finlayson, M.; Halpern, B.S.; Jorge, M.A.; Lombana, A.; Lourie, S.A.; et al. Marine Ecoregions of the World: A Bioregionalization of Coastal and Shelf Areas. *Bioscience* **2007**, *57*, 573–583, doi:10.1641/B570707.
81. Hughes, T.P.; Barnes, M.L.; Bellwood, D.R.; Cinner, J.E.; Cumming, G.S.; Jackson, J.B.C.; Kleypas, J.; van de Leemput, I.A.; Lough, J.M.; Morrison, T.H.; et al. Coral Reefs in the Anthropocene. *Nature* **2017**, *546*, 82–90, doi:10.1038/nature22901.
82. Pham, C.K.; Ramirez-Llodra, E.; Alt, C.H.S.; Amaro, T.; Bergmann, M.; Canals, M.; Company, J.B.; Davies, J.; Duineveld, G.; Galgani, F.; et al. Marine Litter Distribution and Density in European Seas, from the Shelves to Deep Basins. *PLoS One* **2014**, *9*, e95839, doi:10.1371/journal.pone.0095839.
83. Larrea, A.; Torres, P.; Seijo, C.; Ventura, M.A.; Costa, A.C.; Parente, M.I.; Lopes, E.; Castaño, D.; Botelho, A.Z. Environmental Coastal Research: A Systematic Review for Azores and Cabo Verde, Two Peripherical Macaronesian Archipelagos. *Front Mar Sci* **2023**, *10*, doi:10.3389/fmars.2023.1242799.
84. Cicin-Sain, B.; Belfiore, S. Linking Marine Protected Areas to Integrated Coastal and Ocean Management: A Review of Theory and Practice. *Ocean Coast Manag* **2005**, *48*, 847–868, doi:10.1016/j.ocecoaman.2006.01.001.
85. Wagner, D.; van der Meer, L.; Gorny, M.; Sellanes, J.; Gaymer, C.F.; Soto, E.H.; Easton, E.E.; Friedlander, A.M.; Lindsay, D.J.; Molodtsova, T.N.; et al. The Salas y Gómez and Nazca Ridges: A Review of the Importance, Opportunities and Challenges for Protecting a Global Diversity Hotspot on the High Seas. *Mar Policy* **2021**, *126*, 104377, doi:10.1016/j.marpol.2020.104377.
86. Bax, N.; Novaglio, C.; Maxwell, K.H.; Meyers, K.; McCann, J.; Jennings, S.; Frusher, S.; Fulton, E.A.; Nursey-Bray, M.; Fischer, M.; et al. Ocean Resource Use: Building the Coastal Blue Economy. *Rev Fish Biol Fish* **2022**, *32*, 189–207, doi:10.1007/s11160-021-09636-0.
87. Gari, S.R.; Newton, A.; Icely, J.D. A Review of the Application and Evolution of the DPSIR Framework with an Emphasis on Coastal Social-Ecological Systems. *Ocean Coast Manag* **2015**, *103*, 63–77, doi:10.1016/j.ocecoaman.2014.11.013.
88. Calado, H.; Borges, P.; Phillips, M.; Ng, K.; Alves, F. The Azores Archipelago, Portugal: Improved Understanding of Small Island Coastal Hazards and Mitigation Measures. *Natural Hazards* **2011**, *58*, 427–444, doi:10.1007/s11069-010-9676-5.
89. Castro, N.; Félix, P.M.; Gestoso, I.; Costa, J.L.; Canning-Clode, J. Management of Non-Indigenous Species in Macaronesia: Misconceptions and Alerts to Decision-Makers. *Mar Pollut Bull* **2024**, *204*, 116506, doi:10.1016/j.marpolbul.2024.116506.

 doi:10.20944/preprints202504.2568.v1

90. McIvor, A.J.; Williams, C.T.; Alves, F.; Dinis, A.; Pais, M.P.; Canning-Clode, J. The Status of Marine Megafauna Research in Macaronesia: A Systematic Review. *Front Mar Sci* **2022**, *9*, 819581, doi:10.3389/fmars.2022.819581.
91. Hawkins, S.J.; Corte-Real, H.B.S.M.; Pannacciulli, F.G.; Weber, L.C.; Bishop, J.D.D. Thoughts on the Ecology and Evolution of the Intertidal Biota of the Azores and Other Atlantic Islands. *Hydrobiologia* **2000**, *440*, 3–17, doi:10.1023/A:1004118220083.
92. MacArthur, R.H.; Wilson, E.O. An Equilibrium Theory of Insular Zoogeography. *Evolution (N Y)* **1963**, *17*, 373–387, doi:10.1111/j.1558-5646.1963.tb03295.x.
93. Kueffer, C.; Drake, D.R.; Fernández-Palacios, J.M. Island Biology: Looking towards the Future. *Biol Lett* **2014**, *10*, 20140719, doi:10.1098/rsbl.2014.0719.
94. Graham, N.R.; Gruner, D.S.; Lim, J.Y.; Gillespie, R.G. Island Ecology and Evolution: Challenges in the Anthropocene. *Environ Conserv* **2017**, *44*, 323–335, doi:10.1017/S0376892917000315.
95. Nogué, S.; Santos, A.M.C.; Birks, H.J.B.; Björck, S.; Castilla-Beltrán, A.; Connor, S.; de Boer, E.J.; de Nascimento, L.; Felde, V.A.; Fernández-Palacios, J.M.; et al. The Human Dimension of Biodiversity Changes on Islands. *Science (1979)* **2021**, *372*, 488–491, doi:10.1126/science.abd6706.
96. Misiuk, B.; Brown, C.J. Benthic Habitat Mapping: A Review of Three Decades of Mapping Biological Patterns on the Seafloor. *EarthArXiv* **2023**, 71, doi:10.31223/X5DD4S.
97. Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Ann Intern Med* **2009**, *151*, 264, doi:10.7326/0003-4819-151-4-200908180-00135.
98. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. Declaración PRISMA 2020: Una Guía Actualizada Para La Publicación de Revisiones Sistemáticas. *Rev Esp Cardiol* **2021**, *74*, 790–799, doi:10.1016/j.recesp.2021.06.016.
99. Fernández-Palacios, J.M.; Whittaker, R.J. The Canaries: An Important Biogeographical Meeting Place. *J Biogeogr* **2008**, *35*, 379–387, doi:10.1111/j.1365-2699.2008.01890.x.
100. EEA *Europe's Biodiversity - Biogeographical Regions and Seas*; 2002;
101. Haroun, R. El Mar Canario. In *Naturaleza de las Islas Canarias. Ecología y Conservación*; Fernández-Palacios, J.M., Martín-Esquivel, J.L., Eds.; Editorial Turquesa, 2001; pp. 103–107.
102. Morton, B.; Britton, J.C.; De Frias, A.M.; Martins, H. *Coastal Ecology of the Azores*; 1998;
103. Valdés, L.; Déniz-González, I. (eds) *Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem*; 2015;
104. Ávila, S.P.; Melo, C.; Berning, B.; Cordeiro, R.; Landau, B.; da Silva, C.M. Persististrombus Coronatus (Mollusca: Strombidae) in the Lower Pliocene of Santa Maria Island (Azores, NE Atlantic): Paleoecology, Paleoclimatology and Paleobiogeographic Implications. *Palaeogeogr Palaeoclimatol Palaeoecol* **2016**, *441*, 912–923, doi:10.1016/j.palaeo.2015.10.043.
105. Tuya, F.; Haroun, R.J. Phytogeography of Lusitanian Macaronesia: Biogeographic Affinities in Species Richness and Assemblage Composition. *Eur J Phycol* **2009**, *44*, 405–413, doi:10.1080/09670260902836246.
106. Freitas, R.; Romeiras, M.; Silva, L.; Cordeiro, R.; Madeira, P.; González, J.A.; Wirtz, P.; Falcón, J.M.; Brito, A.; Floeter, S.R.; et al. Restructuring of the 'Macaronesia' Biogeographic Unit: A Marine Multi-Taxon Biogeographical Approach. *Sci Rep* **2019**, *9*, 15792, doi:10.1038/s41598-019-51786-6.
107. Carine, M.A.; Schaefer, H. The Azores Diversity Enigma: Why Are There so Few Azorean Endemic Flowering Plants and Why Are They so Widespread? *J Biogeogr* **2010**, *37*, 77–89, doi:10.1111/j.1365-2699.2009.02181.x.
108. Emerson, B.C. Evolution on Oceanic Islands: Molecular Phylogenetic Approaches to Understanding Pattern and Process. *Mol Ecol* **2002**, *11*, 951–966, doi:10.1046/j.1365-294X.2002.01507.x.
109. Juan, C.; Emerson, B.C.; Oromí, P.; Hewitt, G.M. Colonization and Diversification: Towards a Phylogeographic Synthesis for the Canary Islands. *Trends Ecol Evol* **2000**, *15*, 104–109, doi:10.1016/S0169-5347(99)01776-0.
110. Whittaker, R.J.; Fernández-Palacios, J.M. *Island Biogeography: Ecology, Evolution, and Conservation*; Second.; Oxford University Press, 2007;

111. Haddaway, N.R.; Page, M.J.; Pritchard, C.C.; McGuinness, L.A. PRISMA2020: An R Package and Shiny App for Producing PRISMA 2020-compliant Flow Diagrams, with Interactivity for Optimised Digital Transparency and Open Synthesis. *Campbell Systematic Reviews* **2022**, *18*, doi:10.1002/cl2.1230.
112. Mayorga-Ponce, R.B.; Monroy-Hernández, A.; Hernández-Rubio, J.; Roldan-Carpio, A.; Reyes-Torres, S.B. Programa SPSS. *Educación y Salud Boletín Científico Instituto de Ciencias de la Salud Universidad Autónoma del Estado de Hidalgo* **2021**, *10*, 282–284, doi:10.29057/icsa.v10i19.7761.
113. Hammer, Ø.; Harper, D.A. Past: Paleontological Statistics Software Package for Educaton and Data Anlysis. *Palaeontologia electronica* **2001**, *4*, 9.
114. Ribeiro, C.; Neves, P. Habitat Mapping of Cabo Girão Marine Park (Madeira Island): A Tool for Conservation and Management. *J Coast Conserv* **2020**, *24*, 22, doi:10.1007/s11852-019-00724-9.
115. Scepanski, D.; Augustin, N.; Dünn, M.; Scherwaß, A.; Xavier, J.R.; Werner, J.; Waldvogel, A.M.; Arndt, H. Vertical Distribution of Epibenthic Megafauna of a Large Seamount West of Cape Verde Islands (Tropical North Atlantic). *Marine Biodiversity* **2024**, *54*, 6, doi:10.1007/s12526-023-01400-w.
116. Tempera, F.; Pereira, J.N.; Henriques, A.B.; Porteiro, F.M.; Morato, T.; de Matos, V.; Souto, M.; Guillaumont, B.; Serrão Santos, R. Cataloguing Deep-Sea Biological Facies of the Azores. *Revista de Investigación Marina* **2012**, *19*, 36–38.
117. Doxa, A.; Holon, F.; Deter, J.; Villéger, S.; Boissery, P.; Mouquet, N. Mapping Biodiversity in Three-Dimensions Challenges Marine Conservation Strategies: The Example of Coralligenous Assemblages in North-Western Mediterranean Sea. *Ecol Indic* **2016**, *61*, 1042–1054, doi:10.1016/j.ecolind.2015.10.062.
118. Coggan, R.; Populus, J.; White, J.; Sheehan, K.; Fitzpatrick, F.; Piel, S. Review of Standards and Protocols for Seabed Habitat Mapping. In *Mapping European Seabed Habitats (MESH)*; Peterborough, UK., 2007; pp. 106–203.
119. Van Rein, H.; Brown, C.J.; Quinn, R.; Breen, J. A Review of Sublittoral Monitoring Methods in Temperate Waters: A Focus on Scale. *Underwater Technology* **2009**, *28*, 1–15, doi:10.3723/ut.28.099.
120. Álvaro, N. V.; Wallenstein, F.F.M.M.; Neto, A.I.; Nogueira, E.M.; Ferreira, J.; Santos, C.I.; Amaral, A.F. The Use of Digital Photography for the Definition of Coastal Biotopes in Azores. *Hydrobiologia* **2008**, *596*, 143–152, doi:10.1007/s10750-007-9064-7.
121. Ferretti, R.; Bibuli, M.; Caccia, M.; Chiarella, D.; Odetti, A.; Ranieri, A.; Zereik, E.; Bruzzone, G. Machine Learning Methods for Acoustic-Based Automatic Posidonia Meadows Detection by Means of Unmanned Marine Vehicles. In Proceedings of the OCEANS 2017 - Aberdeen; IEEE, 2017; pp. 1–6.
122. Ierodiaconou, D.; Schimel, A.C.G.; Kennedy, D.; Monk, J.; Gaylard, G.; Young, M.; Diesing, M.; Rattray, A. Combining Pixel and Object Based Image Analysis of Ultra-High Resolution Multibeam Bathymetry and Backscatter for Habitat Mapping in Shallow Marine Waters. *Marine Geophysical Research* **2018**, *39*, 271–288, doi:10.1007/s11001-017-9338-z.
123. Moore, C.H.; Harvey, E.S.; Van Niel, K.P. Spatial Prediction of Demersal Fish Distributions: Enhancing Our Understanding of Species–Environment Relationships. *ICES Journal of Marine Science* **2009**, *66*, 2068–2075, doi:10.1093/icesjms/fsp205.
124. Kocak, D.M.; Dalgleish, F.R.; Caimi, F.M.; Schechner, Y.Y. A Focus on Recent Developments and Trends in Underwater Imaging. *Mar Technol Soc J* **2008**, *42*, 52–67, doi:10.4031/002533208786861209.
125. Robert, K.; Jones, D.O.B.; Tyler, P.A.; Van Rooij, D.; Huvenne, V.A.I. Finding the Hotspots within a Biodiversity Hotspot: Fine-scale Biological Predictions within a Submarine Canyon Using High-resolution Acoustic Mapping Techniques. *Marine Ecology* **2015**, *36*, 1256–1276, doi:10.1111/maec.12228.
126. Pearman, T.R.R.; Robert, K.; Callaway, A.; Hall, R.; Lo Iacono, C.; Huvenne, V.A.I. Improving the Predictive Capability of Benthic Species Distribution Models by Incorporating Oceanographic Data – Towards Holistic Ecological Modelling of a Submarine Canyon. *Prog Oceanogr* **2020**, *184*, 102338, doi:10.1016/j.pocean.2020.102338.
127. Williams, S.B.; Pizarro, O.; Jakuba, M.; Barrett, N. AUV Benthic Habitat Mapping in South Eastern Tasmania. In; 2010; pp. 275–284.
128. Williams, S.B.; Pizarro, O.R.; Jakuba, M. V.; Johnson, C.R.; Barrett, N.S.; Babcock, R.C.; Kendrick, G.A.; Steinberg, P.D.; Heyward, A.J.; Doherty, P.J.; et al. Monitoring of Benthic Reference Sites: Using an Autonomous Underwater Vehicle. *IEEE Robot Autom Mag* **2012**, *19*, 73–84, doi:10.1109/MRA.2011.2181772.

129. Gomes-Pereira, J.N.; Carmo, V.; Catarino, D.; Jakobsen, J.; Alvarez, H.; Aguilar, R.; Hart, J.; Giacomello, E.; Menezes, G.; Stefanni, S.; et al. Cold-Water Corals and Large Hydrozoans Provide Essential Fish Habitat for Lappanella Fasciata and Benthocometes Robustus. *Deep Sea Res 2 Top Stud Oceanogr* **2017**, *145*, 33–48, doi:10.1016/j.dsr2.2017.09.015.
130. Martín García, L.; Rancel-Rodríguez, N.M.; Sangil, C.; Reyes, J.; Benito, B.; Orellana, S.; Sansón, M. Environmental and Human Factors Drive the Subtropical Marine Forests of Gongolaria Abies-Marina to Extinction. *Mar Environ Res* **2022**, *181*, 105759, doi:10.1016/j.marenvres.2022.105759.
131. Tittley, I.; Neto, A.I. A Provisional Classification of Algal-Characterised Rocky Shore Biotopes in the Azores. *Hydrobiologia* **2000**, *440*, 19–25, doi:10.1023/A:1004172321900.
132. Van Rein, H.; Brown, C.J.; Quinn, R.; Breen, J.; Schoeman, D. An Evaluation of Acoustic Seabed Classification Techniques for Marine Biotope Monitoring over Broad-Scales (>1 Km2) and Meso-Scales (10 M2-1 Km2). *Estuar Coast Shelf Sci* **2011**, *93*, 336–349, doi:10.1016/j.ecss.2011.04.011.
133. Sabol, B.; Graves, M.; Preston, J. Evaluation of Multibeam Hydrographic System Performance in Dense Seagrass. *Proceedings Hydro2007* **2007**, 14–17.
134. Fish, J.P.; Carr, A.H. *Sound Underwater Images. A Guide to the Generation and Interpretation of Side-Scan Sonar Data*; American Underwater Search and Surveys Ltd., Lower Cape Publishing Orleans, MA., 1990;
135. Kenny, A.J.; Cato, I.; Desprez, M.; Fader, G.; Schüttenhelm, R.T.E.; Side, J. An Overview of Seabed-Mapping Technologies in the Context of Marine Habitat Classification. *ICES Journal of Marine Science* **2003**, *60*, 411–418, doi:10.1016/S1054-3139(03)00006-7.
136. Giusti, M.; Cerrano, C.; Angiolillo, M.; Tunesi, L.; Canese, S. An Updated Overview of the Geographic and Bathymetric Distribution of Savalia Savaglia. *Mediterr Mar Sci* **2015**, *16*, 128–135, doi:10.12681/mms.890.
137. Green, M.; Cunningham, D. Seabed Imaging Techniques. *Hydro International* **1998**, *2*, 4.
138. Foster-Smith, R.; Gilliland, P. Mapping the Seabed. *Coast-NET* **1997**, *2*, 1.
139. Hughes Clarke, J.E. Detecting Small Seabed Targets Using High-Frequency Multibeam Sonar. *Sea Technology* **1998**, *6*, 87–90.
140. Braga-Henriques, A.; Buhl-Mortensen, P.; Tokat, E.; Martins, A.; Silva, T.; Jakobsen, J.; Canning-Clode, J.; Jakobsen, K.; Delgado, J.; Voirand, T.; et al. Benthic Community Zonation from Mesophotic to Deep Sea: Description of First Deep-Water Kelp Forest and Coral Gardens in the Madeira Archipelago (Central NE Atlantic). *Front Mar Sci* **2022**, *9*, 973364, doi:10.3389/fmars.2022.973364.
141. Kalwa, J.; Carreiro-Silva, M.; Tempera, F.; Fontes, J.; Santos, R.S.; Fabri, M.-C.; Brignone, L.; Ridao, P.; Birk, A.; Glotzbach, T.; et al. The MORPH Concept and Its Application in Marine Research. In Proceedings of the 2013 MTS/IEEE OCEANS - Bergen; IEEE, 2013; pp. 1–8.
142. Tempera, F.; MacKenzie, M.; Bashmachnikov, I.; Puotinen, M.; Santos, R.S.; Bates, R. Predictive Modeling of Dominant Macroalgae Abundance on Temperate Island Shelves (Azores, Northeast Atlantic). In *Seafloor Geomorphology as Benthic Habitat*; Elsevier Inc., 2012; pp. 169–184 ISBN 9780123851406.
143. Girard, F.; Sarrazin, J.; Arnaubec, A.; Cannat, M.; Sarradin, P.M.; Wheeler, B.; Matabos, M. Currents and Topography Drive Assemblage Distribution on an Active Hydrothermal Edifice. *Prog Oceanogr* **2020**, *187*, 102397, doi:10.1016/j.pocean.2020.102397.
144. Somoza, L.; Medialdea, T.; González, F.J.; Calado, A.; Afonso, A.; Albuquerque, M.; Asensio-Ramos, M.; Bettencourt, R.; Blasco, I.; Candón, J.A.; et al. Multidisciplinary Scientific Cruise to the Northern Mid-Atlantic Ridge and Azores Archipelago. *Front Mar Sci* **2020**, *7*, 568035, doi:10.3389/fmars.2020.568035.
145. De Falco, G.; Tonielli, R.; Di Martino, G.; Innangi, S.; Simeone, S.; Michael Parnum, I. Relationships between Multibeam Backscatter, Sediment Grain Size and Posidonia Oceanica Seagrass Distribution. *Cont Shelf Res* **2010**, *30*, 1941–1950, doi:10.1016/j.csr.2010.09.006.
146. Feldens, P.; Held, P.; Otero-Ferrer, F.; Bramanti, L.; Espino, F.; Schneider von Deimling, J. Can Black Coral Forests Be Detected Using Multibeam Echosounder "Multi-Detect" Data? *Frontiers in Remote Sensing* **2023**, *4*, 988366, doi:10.3389/frsen.2023.988366.
147. Purkis, S.J.; Gleason, A.C.R.; Purkis, C.R.; Dempsey, A.C.; Renaud, P.G.; Faisal, M.; Saul, S.; Kerr, J.M. High-Resolution Habitat and Bathymetry Maps for 65,000 Sq. Km of Earth's Remotest Coral Reefs. *Coral Reefs* **2019**, *38*, 467–488, doi:10.1007/s00338-019-01802-y.

148. Valdazo, J.; Coca, J.; Haroun, R.; Bergasa, O.; Viera-Rodríguez, M.A.; Tuya, F. Local and Global Stressors as Major Drivers of the Drastic Regression of Brown Macroalgae Forests in an Oceanic Island. *Reg Environ Change* **2024**, *24*, 65, doi:10.1007/s10113-024-02228-1.
149. Monteiro, J.G.; Jiménez, J.L.; Gizzi, F.; Přikryl, P.; Lefcheck, J.S.; Santos, R.S.; Canning-Clode, J. Novel Approach to Enhance Coastal Habitat and Biotope Mapping with Drone Aerial Imagery Analysis. *Sci Rep* **2021**, *11*, 574, doi:10.1038/s41598-020-80612-7.
150. Kellaris, A.; Gil, A.; Faria, J.; Amaral, R.; Moreu-Badia, I.; Neto, A.; Yesson, C. Using Low-cost Drones to Monitor Heterogeneous Submerged Seaweed Habitats: A Case Study in the Azores. *Aquat Conserv* **2019**, *29*, 1909–1922, doi:10.1002/aqc.3189.
151. Valdazo, J.; Ferrer, N.; Vega, C.; Martín, J.; Luque, Á.; Bergasa, O. Mapping Marine Habitats in a Shallow Beach-Reef Environment Combining Direct Methods and Hyperspectral Remote Sensing. *Ocean Coast Manag* **2024**, *255*, 107231, doi:10.1016/j.ocecoaman.2024.107231.
152. Cerdeira-Estrada, S.; Heege, T.; Kolb, M.; Ohlendorf, S.; Uribe, A.; Muller, A.; Garza, R.; Ressl, R.; Aguirre, R.; Marino, I.; et al. Benthic Habitat and Bathymetry Mapping of Shallow Waters in Puerto Morelos Reefs Using Remote Sensing with a Physics Based Data Processing. In Proceedings of the IEEE International Geoscience and Remote Sensing Symposium; IEEE, 2012; pp. 4383–4386.
153. Poursanidis, D.; Traganos, D.; Teixeira, L.; Shapiro, A.; Muaves, L. Cloud-native Seascape Mapping of Mozambique's Quirimbas National Park with Sentinel-2. *Remote Sens Ecol Conserv* **2021**, *7*, 275–291, doi:10.1002/rse2.187.
154. Borfecchia, F.; Consalvi, N.; Micheli, C.; Carli, F.M.; Cognetti De Martiis, S.; Gnisci, V.; Piermattei, V.; Belmonte, A.; De Cecco, L.; Bonamano, S.; et al. Landsat 8 OLI Satellite Data for Mapping of the *Posidonia Oceanica* and Benthic Habitats of Coastal Ecosystems. *Int J Remote Sens* **2019**, *40*, 1548–1575, doi:10.1080/01431161.2018.1528020.
155. Doukari, M.; Topouzelis, K. UAS Data Acquisition Protocol For Marine Habitat Mapping: An Accuracy Assessment Study. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* **2020**, *XLIII-B3-2020*, 1321–1326, doi:10.5194/isprs-archives-XLIII-B3-2020-1321-2020.
156. Ventura, D.; Bonifazi, A.; Gravina, M.F.; Belluscio, A.; Ardizzone, G. Mapping and Classification of Ecologically Sensitive Marine Habitats Using Unmanned Aerial Vehicle (UAV) Imagery and Object-Based Image Analysis (OBIA). *Remote Sens (Basel)* **2018**, *10*, 1331, doi:10.3390/rs10091331.
157. Hedley, J.; Roelfsema, C.; Chollett, I.; Harborne, A.; Heron, S.; Weeks, S.; Skirving, W.; Strong, A.; Eakin, C.; Christensen, T.; et al. Remote Sensing of Coral Reefs for Monitoring and Management: A Review. *Remote Sens (Basel)* **2016**, *8*, 118, doi:10.3390/rs8020118.
158. Rovelli, L.; Carreiro-Silva, M.; Attard, K.M.; Rakka, M.; Dominguez-Carrió, C.; Bilan, M.; Blackbird, S.; Morato, T.; Wolff, G.A.; Glud, R.N. Benthic O2 Uptake by Coral Gardens at the Condor Seamount (Azores). *Mar Ecol Prog Ser* **2022**, *688*, 19–31, doi:10.3354/meps14021.
159. Zweng, M.M.; Reagan, J.R.; Antonov, J.I.; Locarnini, R.A.; Mishonov, A.V.; Boyer, T.P.; Garcia, H.E.; Baranova, O.K.; Johnson, D.R.; Seidov, D.; et al. World Ocean Atlas 2013, Volume 2: Salinity. In *NOAA Atlas NESDIS*; Levitus, S., Mishonov, A., Eds.; 2013; Vol. 74, p. 39.
160. Eugenio, F.; Mederos-Barrera, A.; Marcello, J. High-Resolution Satellite Monitoring of Vulnerable Coastal Ecosystems Using Advanced Artificial Intelligence Techniques. In Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS); IEEE, 2023; Vol. 2023-July, pp. 4104–4107.
161. Marcello, J.; Eugenio, F.; Marques, F.; Martin, J. Precise Classification of Coastal Benthic Habitats Using High Resolution Worldview-2 Imagery. In Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS); Institute of Electrical and Electronics Engineers Inc., 2015; Vol. 2015-November, pp. 2307–2310.
162. Mendoza, J.C.; Clemente, S.; Hernández, J.C. Modeling the Role of Marine Protected Areas on the Recovery of Shallow Rocky Reef Ecosystem after a Catastrophic Submarine Volcanic Eruption. *Mar Environ Res* **2020**, *155*, 104877, doi:10.1016/j.marenvres.2020.104877.
163. Mederos-Barrera, A.; Sevilla, J.; Marcello, J.; Espinosa, J.M.; Eugenio, F. Effects of the Construction of Granadilla Industrial Port in Seagrass and Seaweed Habitats Using Very-High-Resolution Multispectral Satellite Imagery. *Remote Sens (Basel)* **2024**, *16*, 945, doi:10.3390/rs16060945.

164. Casas, E.; Martín-García, L.; Otero-Ferrer, F.; Tuya, F.; Haroun, R.; Arbelo, M. Economic Mapping and Assessment of Cymodocea Nodosa Meadows as Nursery Grounds for Commercially Important Fish Species. A Case Study in the Canary Islands. *One Ecosystem* **2021**, *6*, doi:10.3897/oneeco.6.e70919.
165. Eugenio, F.; Marcello, J.; Martin, J.; Rodríguez-Esparragón, D. Benthic Habitat Mapping Using Multispectral High-Resolution Imagery: Evaluation of Shallow Water Atmospheric Correction Techniques. *Sensors (Switzerland)* **2017**, *17*, 2639, doi:10.3390/s17112639.
166. Vasquez, M.; Mata Chacón, D.; Tempera, F.; O'Keeffe, E.; Galparsoro, I.; Sanz Alonso, J.L.; Gonçalves, J.M.S.; Bentes, L.; Amorim, P.; Henriques, V.; et al. Broad-Scale Mapping of Seafloor Habitats in the North-East Atlantic Using Existing Environmental Data. *J Sea Res* **2015**, *100*, 120–132, doi:10.1016/j.seares.2014.09.011.
167. Puerta, P.; Mosquera-Giménez, Á.; Reñones, O.; Domínguez-Carrió, C.; Rueda, J.L.; Urra, J.; Carreiro-Silva, M.; Blasco-Ferre, J.; Santana, Y.; Gutiérrez-Zárate, C.; et al. Variability of Deep-Sea Megabenthic Assemblages along the Western Pathway of the Mediterranean Outflow Water. *Deep Sea Res 1 Oceanogr Res Pap* **2022**, *185*, 103791, doi:10.1016/j.dsr.2022.103791.
168. Marcos, C.; Díaz, D.; Fietz, K.; Forcada, A.; Ford, A.; García-Charton, J.A.; Goñi, R.; Lenfant, P.; Mallol, S.; Mouillot, D.; et al. Reviewing the Ecosystem Services, Societal Goods, and Benefits of Marine Protected Areas. *Front Mar Sci* **2021**, *8*, 613819, doi:10.3389/fmars.2021.613819.
169. Brown, C.J.; Smith, S.J.; Lawton, P.; Anderson, J.T. Benthic Habitat Mapping: A Review of Progress towards Improved Understanding of the Spatial Ecology of the Seafloor Using Acoustic Techniques. *Estuar Coast Shelf Sci* **2011**, *92*, 502–520, doi:10.1016/j.ecss.2011.02.007.
170. Mayer, L.A. Frontiers in Seafloor Mapping and Visualization. *Mar Geophys Res (Dordr)* **2006**, *27*, 7–17, doi:10.1007/s11001-005-0267-x.
171. Lecours, V.; Dolan, M.F.J.; Micallef, A.; Lucieer, V.L. A Review of Marine Geomorphometry, the Quantitative Study of the Seafloor. *Hydrol Earth Syst Sci* **2016**, *20*, 3207–3244, doi:10.5194/hess-20-3207-2016.
172. Grohmann, C.H. Morphometric Analysis in Geographic Information Systems: Applications of Free Software GRASS and R. *Comput Geosci* **2004**, *30*, 1055–1067, doi:10.1016/j.cageo.2004.08.002.
173. Schäfer, S.; Monteiro, J.; Castro, N.; Gizzi, F.; Henriques, F.; Ramalhosa, P.; Parente, M.I.; Rilov, G.; Gestoso, I.; Canning-Clode, J. Lost and Found: A New Hope for the Seagrass Cymodocea Nodosa in the Marine Ecosystem of a Subtropical Atlantic Island. *Reg Stud Mar Sci* **2021**, *41*, 101575, doi:10.1016/j.rsma.2020.101575.
174. Gumusay, M.U.; Bakirman, T.; Tuney Kizilkaya, I.; Aykut, N.O. A Review of Seagrass Detection, Mapping and Monitoring Applications Using Acoustic Systems. *Eur J Remote Sens* **2019**, *52*, 1–29, doi:10.1080/22797254.2018.1544838.
175. Neves, P.; Silva, J.; Peña, V.; Ribeiro, C. "Pink Round Stones"—Rhodolith Beds: An Overlooked Habitat in Madeira Archipelago. *Biodivers Conserv* **2021**, *30*, 3359–3383, doi:10.1007/s10531-021-02251-2.
176. Braga-Henriques, A.; Porteiro, F.M.; Ribeiro, P.A.; De Matos, V.; Sampaio, Í.; Ocaña, O.; Santos, R.S. Diversity, Distribution and Spatial Structure of the Cold-Water Coral Fauna of the Azores (NE Atlantic). *Biogeosciences* **2013**, *10*, 4009–4036, doi:10.5194/bg-10-4009-2013.
177. Warren, D.L.; Glor, R.E.; Turelli, M. ENVIRONMENTAL NICHE EQUIVALENCY VERSUS CONSERVATISM: QUANTITATIVE APPROACHES TO NICHE EVOLUTION. *Evolution (N Y)* **2008**, *62*, 2868–2883, doi:10.1111/j.1558-5646.2008.00482.x.
178. Melo-Merino, S.M.; Reyes-Bonilla, H.; Lira-Noriega, A. Ecological Niche Models and Species Distribution Models in Marine Environments: A Literature Review and Spatial Analysis of Evidence. *Ecol Modell* **2020**, *415*, 108837, doi:10.1016/j.ecolmodel.2019.108837.
179. Pearson, R.G.; Dawson, T.P.; Liu, C. Modelling Species Distributions in Britain: A Hierarchical Integration of Climate and Land-cover Data. *Ecography* **2004**, *27*, 285–298, doi:10.1111/j.0906-7590.2004.03740.x.
180. Hu, Z.; Hu, J.; Hu, H.; Zhou, Y. Predictive Habitat Suitability Modeling of Deep-Sea Framework-Forming Scleractinian Corals in the Gulf of Mexico. *Science of The Total Environment* **2020**, *742*, 140562, doi:10.1016/j.scitotenv.2020.140562.

181. Cordero-Penín, V.; Abramic, A.; García-Mendoza, A.; Otero-Ferrer, F.; Haroun, R. Mapping Marine Ecosystem Services Potential across an Oceanic Archipelago: Applicability and Limitations for Decision-Making. *Ecosyst Serv* **2023**, *60*, 101517, doi:10.1016/j.ecoser.2023.101517.
182. Vinha, B.; Murillo, F.J.; Schumacher, M.; Hansteen, T.H.; Schwarzkopf, F.U.; Biastoch, A.; Kenchington, E.; Piraino, S.; Orejas, C.; Huvenne, V.A.I. Ensemble Modelling to Predict the Distribution of Vulnerable Marine Ecosystems Indicator Taxa on Data-Limited Seamounts of Cabo Verde (NW Africa). *Divers Distrib* **2024**, *30*, e13896, doi:10.1111/ddi.13896.
183. Gonzalez-Lorenzo, G.; Toledo-Guedes, K.; Rodríguez-Riesco, E.; González-Méndez, E.; González-Rodríguez, Y.; Piñeiro-Corbeira, C. The Underreported Presence of the Subtidal Seagrass Cymodocea Nodosa in Rocky Intertidal Pools of the Canary Islands. *Marine Biology Research* **2020**, *16*, 550–555, doi:10.1080/17451000.2020.1834583.
184. Martín-García, L.; González-Lorenzo, G.; Brito-Izquierdo, I.T.; Barquín-Diez, J. Use of Topographic Predictors for Macrobenthic Community Mapping in the Marine Reserve of La Palma (Canary Islands, Spain). *Ecol Modell* **2013**, *263*, 19–31, doi:10.1016/j.ecolmodel.2013.04.005.
185. Wienberg, C.; Wintersteller, P.; Beuck, L.; Hebbeln, D. Coral Patch Seamount (NE Atlantic) – a Sedimentological and Macrofaunal Reconnaissance Based on Video and Hydroacoustic Surveys. *Biogeosciences Discussions* **2012**, *9*, 18707–18753, doi:10.5194/bgd-9-18707-2012.
186. Desbruyères, D.; Almeida, A.; Biscoito, M.; Comtet, T.; Khripounoff, A.; Le Bris, N.; Sarradin, P.M.; Segonzac, M. A Review of the Distribution of Hydrothermal Vent Communities along the Northern Mid-Atlantic Ridge: Dispersal vs. Environmental Controls. *Hydrobiologia* **2000**, *440*, 201–216, doi:10.1023/A:1004175211848.
187. ICES *Report of the Working Group on Marine Habitat Mapping (WGMHM)*; Galway, Ireland, 2006;
188. Shumchenia, E.J.; King, J.W. Comparison of Methods for Integrating Biological and Physical Data for Marine Habitat Mapping and Classification. *Cont Shelf Res* **2010**, *30*, 1717–1729, doi:10.1016/j.csr.2010.07.007.
189. Galparsoro, I.; Connor, D.W.; Borja, Á.; Aish, A.; Amorim, P.; Bajjouk, T.; Chambers, C.; Coggan, R.; Dirberg, G.; Ellwood, H.; et al. Using EUNIS Habitat Classification for Benthic Mapping in European Seas: Present Concerns and Future Needs. *Mar Pollut Bull* **2012**, *64*, 2630–2638, doi:10.1016/j.marpolbul.2012.10.010.
190. Strong, J.A.; Clements, A.; Lillis, H.; Galparsoro, I.; Bildstein, T.; Pesch, R. A Review of the Influence of Marine Habitat Classification Schemes on Mapping Studies: Inherent Assumptions, Influence on End Products, and Suggestions for Future Developments. *ICES Journal of Marine Science* **2019**, *76*, 10–22, doi:10.1093/icesjms/fsy161.
191. Ierodianconou, D.; Monk, J.; Rattray, A.; Laurenson, L.; Versace, V.L. Comparison of Automated Classification Techniques for Predicting Biological Communities Using Hydroacoutics and Video Observations. *Cont Shelf Res* **2011**, *31*, S28–S38, doi:10.1016/j.csr.2010.01.012.
192. Diaz, R.J.; Solan, M.; Valente, R.M. A Review of Approaches for Classifying Benthic Habitats and Evaluating Habitat Quality. *J Environ Manage* **2004**, *73*, 165–181, doi:10.1016/j.jenvman.2004.06.004.
193. Laban, C. Seabed Mapping. *Hydro International* **1998**, *2*, 4.
194. Rivera, J.; Canals, M.; Lastras, G.; Hermida, N.; Amblas, D.; Arrese, B.; Martín-Sosa, P.; Acosta, J. Morphometry of Concepcion Bank: Evidence of Geological and Biological Processes on a Large Volcanic Seamount of the Canary Islands Seamount Province. *PLoS One* **2016**, *11*, e0156337, doi:10.1371/journal.pone.0156337.
195. Pham, C.K.; Diogo, H.; Menezes, G.; Porteiro, F.; Braga-Henriques, A.; Vandeperre, F.; Morato, T. Deep-Water Longline Fishing Has Reduced Impact on Vulnerable Marine Ecosystems. *Sci Rep* **2014**, *4*, 4837, doi:10.1038/srep04837.
196. Tuya, F.; Ribeiro-Leite, L.; Arto-Cuesta, N.; Coca, J.; Haroun, R.; Espino, F. Decadal Changes in the Structure of Cymodocea Nodosa Seagrass Meadows: Natural vs. Human Influences. *Estuar Coast Shelf Sci* **2014**, *137*, 41–49, doi:10.1016/j.ecss.2013.11.026.
197. Duncan, E.M.; Vieira, N.; González-Irusta, J.M.; Dominguez-Carrió, C.; Morato, T.; Carreiro-Silva, M.; Jakobsen, J.; Jakobsen, K.; Porteiro, F.; Schläpfer, N.; et al. Predicting the Distribution and Abundance of

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Abandoned, Lost or Discarded Fishing Gear (ALDFG) in the Deep Sea of the Azores (North Atlantic). *Science of the Total Environment* **2023**, *900*, 166579, doi:10.1016/j.scitotenv.2023.166579.

198. Ribeiro, C.; Neves, P.; Kaufmann, M.; Araújo, R.; Riera, R. A Baseline for Prioritizing the Conservation of the Threatened Seagrass Cymodocea Nodosa in the Oceanic Archipelago of Madeira. *J Nat Conserv* **2022**, *68*, 126224, doi:10.1016/j.jnc.2022.126224.
199. Tempera, F.; Milla-Figueras, D.; Sinde-Mano, A.L.; Atchoi, E.; Afonso, P. Range Extension of Mesophotic Kelps (Ochrophyta: Laminariales and Tilopteridales) in the Central North Atlantic: Opportunities for Marine Forest Research and Conservation. *J Phycol* **2021**, *57*, 1140–1150, doi:10.1111/jpy.13162.
200. López, C.; Clemente, S.; Moreno, S.; Ocaña, O.; Herrera, R.; Moro, L.; Monterroso, O.; Rodríguez, A.; Brito, A. Invasive Tubastraea Spp. and Oculina Patagonica and Other Introduced Scleractinians Corals in the Santa Cruz de Tenerife (Canary Islands) Harbor: Ecology and Potential Risks. *Reg Stud Mar Sci* **2019**, *29*, 100713, doi:10.1016/j.rsma.2019.100713.
201. Somoza, L.; Rueda, J.L.; Sánchez-Guillamón, O.; Medialdea, T.; Rincón-Tomás, B.; González, F.J.; Palomino, D.; Madureira, P.; López-Pamo, E.; Fernández-Salas, L.M.; et al. The Interactive Role of Hydrocarbon Seeps, Hydrothermal Vents and Intermediate Antarctic/Mediterranean Water Masses on the Distribution of Some Vulnerable Deep-Sea Habitats in Mid Latitude NE Atlantic Ocean. *Oceans* **2021**, *2*, 351–385, doi:10.3390/oceans2020021.
202. Riera, R.; Rodríguez, M.; Ramos, E.; Monterroso, Ó.; Delgado, J.D. Hard and Soft-Bottom Macrozoobenthos in Subtidal Communities around an Inactive Harbour Area (Gran Canaria, Canary Islands). *Life and Environment* **2013**, *63*, 23–34.
203. Wallenstein, F.M.; Neto, A.I.; Álvaro, N. V.; Santos, C.I. Algae-Based Biotopes of the Azores (Portugal): Spatial and Seasonal Variation. *Aquat Ecol* **2008**, *42*, 547–559, doi:10.1007/s10452-007-9134-y.
204. Neto, A.I. Contribution to the Taxonomy and Ecology of the Azorean Benthic Marine Algae. *Biological Journal of the Linnean Society* **1992**, *46*, 163–176, doi:10.1111/j.1095-8312.1992.tb00858.x.
205. Morato, T.; Dominguez-Carrió, C.; Mohn, C.; Ocaña Vicente, O.; Ramos, M.; Rodrigues, L.; Sampaio, Í.; Taranto, G.H.; Fauconnet, L.; Tojeira, I.; et al. Dense Cold-Water Coral Garden of Paragorgia Johnsoni Suggests the Importance of the Mid-Atlantic Ridge for Deep-Sea Biodiversity. *Ecol Evol* **2021**, *11*, 16426–16433, doi:10.1002/ece3.8319.
206. Porteiro, F.M.; Gomes-Pereira, J.N.; Pham, C.K.; Tempera, F.; Santos, R.S. Distribution and Habitat Association of Benthic Fish on the Condor Seamount (NE Atlantic, Azores) from in Situ Observations. *Deep Sea Res 2 Top Stud Oceanogr* **2013**, *98*, 114–128, doi:10.1016/j.dsr2.2013.09.015.
207. Sangil, C.; Martín-Garciá, L.; Afonso-Carrillo, J.; Barquín, J.; Sansón, M. Halimeda Incrassata (Bryopsidales, Chlorophyta) Reaches the Canary Islands: Mid- A Nd Deep-Water Meadows in the Eastern Subtropical Atlantic Ocean. *Botanica Marina* **2018**, *61*, 103–110, doi:10.1515/bot-2017-0104.
208. Cacabelos, E.; Gestoso, I.; Ramalhosa, P.; Riera, L.; Neto, A.I.; Canning-Clode, J. Intertidal Assemblages across Boulders and Rocky Platforms: A Multi-Scaled Approach in a Subtropical Island. *Marine Biodiversity* **2019**, *49*, 2709–2723, doi:10.1007/s12526-019-01000-7.
209. Wallenstein, F.F.M.M.; Neto, A.I. Intertidal Rocky Shore Biotopes of the Azores: A Quantitative Approach. *Helgol Mar Res* **2006**, *60*, 196–206, doi:10.1007/s10152-006-0035-6.
210. Riera, R.; Delgado, J.D.; Rodríguez, M.; Monterroso, Ó.; Ramos, E. Macrofaunal Communities of Threatened Subtidal Maerl Seabeds on Tenerife (Canary Islands, North-East Atlantic Ocean) in Summer. *Acta Oceanologica Sinica* **2012**, *31*, 98–105, doi:10.1007/s13131-012-0181-4.
211. Keller, N.B.; Pasternak, F.A. Madreporic and Gorgonian Corals (Anthozoa: Scleractinia, Gorgonacea) in the Benthos of the African Shelf and Slope in the Canary Upwelling Area. *Oceanology (Wash D C)* **2002**, *42*, 521–526.
212. Montero-Hidalgo, M.; Tuya, F.; Otero-Ferrer, F.; Haroun, R.; Santos-Martín, F. Mapping and Assessing Seagrass Meadows Changes and Blue Carbon under Past, Current, and Future Scenarios. *Science of the Total Environment* **2023**, *872*, 162244, doi:10.1016/j.scitotenv.2023.162244.
213. Tempera, F.; Giacomello, E.; Mitchell, N.C.; Campos, A.S.; Braga Henriques, A.; Bashmachnikov, I.; Martins, A.; Mendonça, A.; Morato, T.; Colaço, A.; et al. Mapping Condor Seamount Seafloor Environment

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 30 April 2025 doi:10.20944/preprints202504.2568.v1

and Associated Biological Assemblages (Azores, Ne Atlantic). In *Seafloor Geomorphology as Benthic Habitat*; Elsevier Inc., 2012; pp. 807–818 ISBN 9780123851406.

214. Valdazo, J.; Viera-Rodríguez, M.A.; Espino, F.; Haroun, R.; Tuya, F. Massive Decline of Cystoseira Abies-Marina Forests in Gran Canaria Island (Canary Islands, Eastern Atlantic). *Sci Mar* **2017**, *81*, 499, doi:10.3989/scimar.04655.23A.
215. Mendoza, J.C.; Clemente, S.; Hernández, J.C. Modeling the Role of Marine Protected Areas after a Catastrophic Submarine Volcanic Eruption. *Mar Environ Res* **2020**, *155*, 104877, doi:10.1016/j.marenvres.2020.104877.
216. Mortensen, P.B.; Buhl-Mortensen, L.; Gebruk, A. V.; Krylova, E.M. Occurrence of Deep-Water Corals on the Mid-Atlantic Ridge Based on MAR-ECO Data. *Deep Sea Res 2 Top Stud Oceanogr* **2008**, *55*, 142–152, doi:10.1016/j.dsr2.2007.09.018.
217. Tojeira, I.; Pinto-Ribeiro, L.; Rafael, T.; Albuquerque, M.; Simões, M.; Calado, A.; Afonso, A.; Ramos, B.; Souto, M.; Bettencourt, R.; et al. Preliminary Deep-Sea Data Analysis Collected at Gloria Seamount, Azores-Biscay Rise. *Cont Shelf Res* **2023**, *267*, 105100, doi:10.1016/j.csr.2023.105100.
218. Sidi Cheikh, M.A.; Bandeira, S.; Soumah, S.; Diouf, G.; Diouf, E.M.; Sanneh, O.; Cardoso, N.; Kujabie, A.; Ndure, M.; John, L.; et al. Seagrasses of West Africa: New Discoveries, Distribution Limits and Prospects for Management. *Diversity (Basel)* **2023**, *15*, 5, doi:10.3390/d15010005.
219. Taranto, G.H.; González-Irusta, J.M.; Dominguez-Carrió, C.; Pham, C.K.; Tempera, F.; Ramos, M.; Gonçalves, G.; Carreiro-Silva, M.; Morato, T. Spatial Distributions, Environmental Drivers and Co-Existence Patterns of Key Cold-Water Corals in the Deep Sea of the Azores (NE Atlantic). *Deep Sea Res 1 Oceanogr Res Pap* **2023**, *197*, 104028, doi:10.1016/j.dsr.2023.104028.
220. Casas, E.; Martín-García, L.; Hernández-Leal, P.; Arbelo, M. Species Distribution Models at Regional Scale: Cymodocea Nodosa Seagrasses. *Remote Sens (Basel)* **2022**, *14*, 4334, doi:10.3390/rs14174334.
221. Wallenstein, F.F.M.M.; Neto, A.I.; Álvaro, N. V.; Tittley, I. Subtidal Rocky Shore Communities of the Azores: Developing a Biotope Survey Method. *J Coast Res* **2008**, *1*, 244–249, doi:10.2112/05-0590.1.
222. Fontán Bouzas, A.; Alcántara-Carrió, J.; Montoya Montes, I.; Barranco Ojeda, A.; Albarracín, S.; Rey Díaz de Rada, J.; Rey Salgado, J. Distribution and Thickness of Sedimentary Facies in the Coastal Dune, Beach and Nearshore Sedimentary System at Maspalomas, Canary Islands. *Geo-Marine Letters* **2013**, *33*, 117–127, doi:10.1007/s00367-012-0313-z.