



Full length article

‘Marine Space Oddities’ - overlapping conservation designations – do we need all the different local, national, regional and global categories?

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ABSTRACT

Marine nature conservation management is based on either defined areas or named species and/or habitats, i.e. those attributes termed conservation objectives. This has created many local, national, regional and global spatial designations, each of which needs to be defined and operationalised by criteria. This study analyses the criteria for eight international designations used to select marine areas of conservation importance. For the different designations, 39 individual criteria were reviewed, interpreted and grouped into 13 main criteria attributes. A multivariate cluster analysis then determined the similarity between designations according to the criteria attributes and the similarity in criteria according to the designations. This indicated redundancy and overlap in the selection criteria of the different designations used by marine management authorities, suggesting that streamlining or consolidating similar designations would enhance efficiency and reduce duplication of effort in marine conservation. This shows a notable flaw in the designations that most not only require a minimum of a single criterion irrespective of the total but that many designations are similar with only semantic differences. Finally, the paper suggests, for further testing, practical steps to enhance the integration of existing conservation designations and gives a comprehensive definition of what a complete conservation designation should include.

1. Introduction

Marine management is designed to fulfil several main aims, including protecting and maintaining natural features, enabling or prioritising human activities and sea use, and allocating space to determine what activities should be where [1,2]. In particular, this should enable protecting marine ecosystem services from which society can obtain goods and benefits after inputting human capital and complementary assets (e.g. [3,4]). The predominant need to protect nature, both for its intrinsic value and to preserve those societal benefits, has led to the establishment of various levels of nature protection. In addition to any nature conservation imperatives, Area-Based Management Tools (ABMT) and Area-Based Conservation Measures (summarised here as ABCM), may have economic and geopolitical repercussions [2,5].

Nature conservation designation and management lay within and are a central feature of wider marine management which has often had a sectoral basis [6,7]. The many marine activities (e.g. listed in [8]) are commonly grouped into sectors. For example, under the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) marine activities are categorised into the following nine

sectors: physical restructuring of rivers, coastlines and seabed; extraction of non-living and living resources; production of energy; cultivation of living resources; transport, urban and industrial uses; tourism and leisure, and security and defence [9]. However, a tenth sector of nature conservation/protection and restoration may be added to represent beneficial activities.

Nature protection is achieved through several designation types promoted by different administrative or non-governmental bodies and legislative instruments operating at local, national, regional or global levels [6,7,10]. These designations have the primary objective of protecting specific ecosystem features and conservation objectives, such as species and habitats, from human activities, and therefore can enable protection mechanisms (such as ‘no take’ fishery zones, no discharge areas, etc.) to be put in place.

The analysis here introduces the various spatial conservation designations, by focusing on the ecological scope of protection, according to the species, habitats and areas being protected. It gives the background to various conservation designations used worldwide, each of which is defined by specific selection criteria aimed at determining the spatial extent of protection and/or the habitats and species to which they apply.

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While these multifaceted criteria may also include economic, social and governance factors, by definition, the emphasis is usually on biological and ecological considerations to achieve biodiversity conservation goals.

This paper, firstly, tabulates the biological and/or ecological criteria of eight specific conservation designations. Based on this, secondly, it addresses the premise of whether all the designations are distinct from each other based on their published criteria, thereby identifying potential overlaps and redundancies. Thirdly, it evaluates the similarity amongst the criteria used across the eight different designations to assess whether certain designations are so similar that they result in unnecessary duplication. Fourthly, this assesses redundancy in designations, by overlapping criteria, and so suggests the need to simplify the designations. Lastly, based on the above, the paper suggests, for further testing, practical steps to enhance the integration of existing conservation designations and it gives a comprehensive definition of what a complete conservation designation should include.

2. Scope of conservation designations included

The scope of this analysis is restricted to ABMT/ABCM plus designations used either internationally and globally or those emanating from the European Union, which serve as exemplars for regional designations elsewhere (Table 1). National and local designations, such as SSSI (Sites of Special Scientific Interest), HPMA (Highly Protected Marine Areas) or NNR (National Nature Reserves) in the UK, or Areas of Interest (AOI) in Canada, are not included here even though they refer to sites designated according to ecological or geomorphological features [2,11]. Similarly, the designation MPA (Marine Protected Area) has not been included even though it is used in many countries but it is based on very general principles criteria such as size, level of protection, age, proximity, and enforcement (e.g. see the 1999 IUCN report - <https://portals.iucn.org/library/efiles/documents/pag-003.pdf>). In addition, the term MPA also encompasses many other designations including those analysed here which would introduce double-counting and circularity into the analysis here; for example the UK Joint Nature Conservation Committee (see JNCC <https://jncc.gov.uk/our-work/about-marine-protected-areas/>) considers each designation as a *de facto* MPA. Hence, MPA designations are not sufficiently precise and are left to each country that they are synonymous with the terms ABMT or ABCM.

Table 1 indicates the official source material for the designations analysed here. Among the spatial designations covered, Vulnerable Marine Ecosystems (VMEs), Particularly Sensitive Sea Areas PSSAs, Ramsar sites, Natura 2000 (that include Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) and Other Effective Conservation Measures (OECMs) may be grouped under ABMTs or ABCMs.

Ecologically or Biologically Significant Marine Areas (EBSAs) and Key Biodiversity Areas (KBAs) are areas that do not have associated management measures. Ramsar sites, SACs, and SPAs with marine components are often considered MPAs, being explicitly recognised as part of the national MPA network (e.g. UK) and/or contributing to broader MPA networks under specific conservation frameworks, such as the OSPAR Marine Protected Area Network (e.g. [12]).

The criteria for each conservation designation type (Supplementary Information Tables S1a-h) indicate the main features by which the sites are designated. In addition to their primary reliance on ecological and biological criteria, the inclusion of additional social, cultural or economic considerations may influence the relative weighting of ecological features in designating a conservation area.

3. Overview of the individual conservation designations

3.1. Ecologically or Biologically Significant Marine Areas (EBSA)

These are special oceanic areas that serve important ecological and/or biological purposes (such as essential habitats, food sources or breeding grounds for particular species), and in one way or another, support the healthy functioning of oceans and the many services, goods and benefits for society that it provides [3,13,14 and references therein]. EBSAs were originally created in response to the need to address marine biodiversity in areas that primarily lie in open ocean waters and deep-sea habitats. Their designation identifies marine areas in need of protection and helps to inform future management measures and/or efforts to establish marine protected areas [14]. Therefore, their identification alone does not entail or require any management or regulatory measures. The seven criteria for identifying EBSAs (Table S1a) were adopted at the Conference of the Parties to the Convention on Biological Diversity (CBD) (COP 9) in 2008 [15]. It is emphasised that while there are seven criteria, a site must rank 'high' in at least one criterion to be recognized as an EBSA but, importantly, not all criteria need to be satisfied.

3.2. Vulnerable Marine Ecosystems (VME)

To prevent significant adverse impacts to deep-sea biodiversity in areas beyond national jurisdiction (ABNJ), in 2006, the United Nations General Assembly (UNGA) called for the identification and protection of VMEs [16]. In response, the UN Food and Agricultural Organization (FAO) developed guidelines for managing deep-sea fisheries in the high seas, outlining the criteria for identifying VMEs and providing examples of indicative taxa [17] (Table S1b). The designation of VMEs therefore has a focus on the effects of bottom fishing to habitats and ecosystems of

Table 1
Conservation designations.

Acronyms	Name	Originator	Website or other reference
EBSA	Ecologically or Biologically Significant Marine Areas	Convention on Biological Diversity (CBD) (2008)	https://www.cbd.int/ebsa/
VME	Vulnerable Marine Ecosystems	Food and Agriculture Organization of the United Nations (FAO) (2006)	https://www.fao.org/in-action/vulnerable-marine-ecosystems/en/
PSSA	Particularly Sensitive Sea Areas	International Maritime Organisation (IMO) (1990)	https://www.imo.org/en/OurWork/Environment/Pages/PSSAs.aspx
OECM	Other Effective Conservation Measures	Convention on Biological Diversity (CBD) (2018)	https://iucn.org/our-union/commissions/group/iucn-wcpa-others-effective-area-based-conservation-measures-specialist#overview
KBA	Key Biodiversity Areas	International Union for Conservation of Nature (IUCN) (2016)	https://www.keybiodiversityareas.org/
Ramsar sites	Sites under the Ramsar Wetlands Convention	Ramsar Wetlands Convention (1971)	https://www.ramsar.org/
Natura 2000	Natura 2000 protected areas network (which include Special Areas of Conservation (SAC) and Special Protection Areas (SPA))	EU (Habitats Directive (1992) and Conservation of Wild Birds Directive (2009))	https://environment.ec.europa.eu/topics/nature-and-biodiversity/natura-2000_en

the deep-sea (e.g., hydrothermal vents, seamounts, or cold seeps, including the use of indicator taxa). As they are identified by regional fisheries management organisations (RFMOs) [18], this may be regarded as a fisheries sectoral designation (see above for the ten sectors).

3.3. Particularly Sensitive Sea Areas (PSSA)

As with VME, the PSSA designation was also created (since 1990) by an international body concerned primarily with one sector (Table S1c). The International Maritime Organisation (IMO) is the United Nations specialised agency responsible for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships. The PSSAs require special protection due to their recognised significance and their vulnerability to damage from international shipping activities. Additionally, there must be measures that can be adopted by the IMO (i.e., associated protective measures, or APMs) to protect the vulnerable area from international shipping. The criteria for designation are divided into three significance categories: ecological; social, economic and cultural, and scientific and educational. As with EBSAs, to qualify as a PSSA, a proposed area need only meet at least one criterion from any of these categories.

3.4. Other Effective Conservation Measures (OECM)

This designation was formally introduced in 2018 by the Convention for Biological Diversity (CBD) to recognise areas that achieve positive sustained and long-term outcomes for biodiversity conservation, even when their primary purpose is not protection. This approach expands conservation efforts by acknowledging effective management practices beyond traditional protected areas (PAs). OECMs are recognised from pre-existing governed/managed areas that are not PAs, but that achieve positive and sustained long-term outcomes for biodiversity conservation. Therefore, they aim to play an important role in implementing Target 3 of the Global Biodiversity Framework: to conserve 30 % of marine, terrestrial, and inland water areas by 2030 [19]. In order to qualify as an OECM, an area must meet specific criteria and it must have clearly defined geographical boundaries, as well as governance and management structures. The area must demonstrate positive and sustained long-term outcomes for biodiversity conservation, including the preservation of ecosystem functions and services, while respecting relevant cultural, spiritual, or socio-economic values. Importantly, the area must not already be recognised as a protected area. Therefore, creating an OECM involves identifying the biodiversity attributes that make the site significant, informed by the best available knowledge. Accordingly, here we have used the biodiversity attributes (criteria) outlined in CBD and IUCN guidelines [20,21] (Table S1d). As a final point, the OECM term is unusual in referring to ‘measures’ rather than an area, i.e., implied management actions.

3.5. Key Biodiversity Areas (KBA)

Another global body, IUCN (International Union for the Conservation of Nature), created yet another wide-ranging designation of Key Biodiversity Areas (Table S1e). They are sites aimed to contribute significantly to the global maintenance of biodiversity [22] but, as with the EBSAs, their identification alone does not entail any management or regulatory measures. As befits the predominant role of the IUCN, the KBAs are designated to protect species at risk. They include areas and habitats but primarily only when these are needed to protect the named species. This designation has been broadened to include communities (more correctly termed assemblages) which together can create a network necessary for maintaining the connectivity necessary for such species [23,24]. It is cautioned here that the term assemblage should imply co-occurrence of species whereas the term community implies co-dependence [25]. The KBA criteria are grouped into five high-level categories, and a site must contribute significantly to the global

persistence of at least one of them (Table S1e). In addition to the criteria and sub-criteria, the KBA Standard [22] defines associated thresholds and assessment parameters.

3.6. Ramsar sites

The Ramsar Site designation is predominantly for wetlands which are fundamental and critical for wetland birds, from the Ramsar, Iran, Convention on Wetland birds and waterbirds (Table S1f). Ramsar Sites are designated under nine criteria for containing representative, rare or unique wetland types or for their importance in conserving biological diversity. Any wetland that meets at least one of the criteria can be designated by the appropriate national authority to be added to the Ramsar list. The sites so designated support given numbers of birds, and/or proportions of birds in an area (hence making the sites internationally or nationally important if they respectively support $\geq 1\%$ of the international or national population). However, it also encompasses the waterbird habitats, their prey/food, and their feeding, roosting and refuge areas. By linking such areas into a network, the sites have the potential to create the long-distance migration routes, e.g., the so-called East Atlantic or West Pacific Flyways [24,26]; it is of note that because of its conservation designations the East Atlantic Flyway is on the tentative UNESCO World Heritage Site list [27].

3.7. Natura 2000

The European Union primary site and species conservation tool, the Natura 2000 protected areas network, includes two designations: SAC (Special Area of Conservation) and SPA (Special Protected Area), originating respectively from the EU Habitats Directive [28] and Conservation of Wild Birds Directive [29]. The Wild Birds Directive is based on named species and does not provide explicit selection criteria for SPAs. Instead, the directive outlines implicit principles, such as the importance for threatened species, vulnerability, rarity and importance for life stages, for named species identified by Member States (Table S1g). EU Member States, with the support of Non-Governmental Organisations (NGOs), are responsible for specifying the criteria for the selection of these areas. However, the SPA criteria leave more discretion for the environmental manager in suggesting ‘account should be taken of ...’.

The SAC designation is also based on named habitats and species (listed in the Annexes of the Directive) and follows a two-stage process: Stage 1, carried by the Member State, which applies specific quantifiable criteria for site selection, and Stage 2, carried by the European Commission on a biogeographical level (Table S1h). It is emphasised that based on the SAC criteria and designation, human activities in the SAC and SPA require permissions following a mandatory Appropriate Assessment for any plan or project which has the potential to adversely affect the conservation objective (i.e., a named species or habitat) [11]. In the analysis here, the Natura2000 designations have been kept together even though they reflect two different EU Directives which focus on different conservation elements. It has been emphasised that these Directives are not designed to be anti-activity but to allow sustainable use of the seas where this is indicated by the Appropriate Assessment (syn. an Environmental Impact Assessment but only focusing on the conservation objectives). The Member States then implement these Directives through national regulations, thereby having control on precise implementation (i.e. the EU principle of subsidiarity).

4. Synthesis of designation criteria

The criteria used by each designation and their definitions/descriptions were then collated to produce a comprehensive Master List (Table 2). This emphasises the breadth of features considered important irrespective of the designation title. The extensive Table 2 details the number of criteria and their wording definition across designations, highlighting the similarities in the topics of the criteria and the links

Table 2

Individual criteria as described by each conservation designation; each bullet point corresponds to a definition from a different designation (with the respective conservation designation indicated in **bold**). The text has been modified for clarity from the resources linked to the cited URL in [Table 1](#) for each category.

Criterion	Description
Biodiversity/ Biological diversity	<ul style="list-style-type: none"> An area that may have an exceptional variety of species or genetic diversity or includes highly varied ecosystems, habitats and communities (PSSA). Area contains comparatively higher diversity of ecosystems, habitats, communities or species, or has higher genetic diversity. Rationale: Important for evolution and maintaining the resilience of marine species and ecosystems (EBSA). Wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region (Ramsar). Wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values. The criterion indicates that a wetland can be designated as internationally important if it has a high diversity of fishes and shellfishes. It emphasises the different forms that diversity might take, including the number of taxa, different life-history stages, species interactions and the complexity of interactions between the above taxa and the external environment. If at least 10 % of fish are endemic to a wetland, or to wetlands in a natural grouping, that site should be recognized as internationally important, but the absence of endemic fishes from a site should not disqualify it if it has other qualifying characteristics (Ramsar).
Site supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations	<ul style="list-style-type: none"> Area contains either (i) unique ('the only one of its kind'), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems, and/or (iii) unique or unusual geomorphological or oceanographic features. Rationale: Irreplaceable; Loss would mean the probable permanent disappearance of diversity or a feature, or reduction of the diversity at any level (EBSA). An area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas or ecosystems. These include habitats that contain endemic species; habitats of rare, threatened or endangered species that occur only in discrete areas; or nurseries or discrete feeding, breeding, or spawning areas (VME). An area or ecosystem is unique if it is 'the only one of its kind'. Habitats of rare, threatened or endangered species that occur only in one area are an example. An area or ecosystem is rare if it occurs only in a few locations or has been seriously depleted across its range. An ecosystem may extend beyond country
Uniqueness or rarity	

Table 2 (continued)

Criterion	Description
Representative, rare or unique wetland types	<p>borders, assuming regional or international significance. Nurseries or certain feeding, breeding or spawning areas may also be rare or unique (PSSA).</p> <ul style="list-style-type: none"> A wetland should be considered internationally important if it contains a representative, rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region (Ramsar).
Irreplaceability	<ul style="list-style-type: none"> Either (a) the likelihood that an area will be required as part of a system that achieves a set of targets [30,60] or (b) the extent to which the options for achieving a set of targets are reduced if the area is unavailable for conservation [31]. Irreplaceability is heavily influenced by geographically restricted biodiversity, but it is a property of an area within a network rather than of an element of biodiversity and is related to the concept of complementarity. This criterion identifies sites that have very high irreplaceability for the global persistence of biodiversity as determined through a complementarity-based quantitative analysis of irreplaceability (KBA).
Importance for life-history stages of species	<ul style="list-style-type: none"> Areas that are required for a population to survive and thrive. Rationale: Various biotic and abiotic conditions coupled with species-specific physiological constraints and preferences tend to make some parts of marine regions more suitable to particular life-stages and functions than other parts (EBSA). Ecosystems especially important for species life stages, feeding, resting, moulting and breeding (OECM). Wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks depend either within the wetland or elsewhere (Ramsar). Wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles or provides refuge during adverse conditions (Ramsar).
Critical habitat	<ul style="list-style-type: none"> A sea area that may be essential for the survival, function or recovery of fish stocks or rare or endangered marine species, or for the support of large marine ecosystems (PSSA).
Biological processes	<ul style="list-style-type: none"> The demographic and life-cycle processes that maintain species such as reproduction and migration. Biological processes identify sites contributing significantly to the global persistence of 1) demographic aggregations, 2) ecological refugia, or 3) recruitment sources. Aggregations are defined as a geographically restricted clustering of individuals that typically occurs during a specific life history stage or process such as breeding, feeding or migration. This clustering is indicated by highly localised relative abundance, two or more orders of magnitude larger than the species' average recorded numbers or densities at other stages during its life-cycle. Ecological refugia hold a significant proportion of the global population

(continued on next page)

Table 2 (continued)

Criterion	Description
	size of a species during periods of environmental stress and so contribute significantly to the global persistence of biodiversity at the species level. Recruitment sources are sites where a significant proportion of the global population size of a species is produced and so contribute significantly to the global persistence of biodiversity at the species level (KBA).
Spawning or breeding grounds	<ul style="list-style-type: none"> An area that may be a critical spawning or breeding ground or nursery area for marine species which may spend the rest of their life-cycle elsewhere, or is recognized as migratory routes for fish, reptiles, birds, mammals or invertebrates (PSSA).
Functional significance of the habitat	<ul style="list-style-type: none"> Discrete areas or habitats that are necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species (VME).
Site regularly supports 20,000 or more waterbirds	<ul style="list-style-type: none"> Wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds. Non-native waterbirds should not be included within the totals for a particular site. The criterion applies not only to multi-species assemblages but also to sites regularly holding more than 20,000 waterbirds of any one species (Ramsar).
Geographically restricted biodiversity	<ul style="list-style-type: none"> A biodiversity element having a restricted global distribution, as measured by range, extent of suitable habitat or area of occupancy, and hence largely confined or endemic to a relatively small portion of the globe such as a bioregion, ecoregion or site. This criterion identifies sites contributing significantly to the global persistence of 1) individual geographically restricted species, 2) co-occurring geographically restricted species, 3) geographically restricted assemblages, or 4) geographically restricted ecosystem types (i.e. holding a significant proportion of the global extent of these features) (KBA).
Range-restricted species and ecosystems in natural settings	<ul style="list-style-type: none"> Significant populations of range-restricted species or ecosystems (OECM).
Isolation of the species population	<ul style="list-style-type: none"> Degree of isolation of the population present on the site in relation to the natural range of the species (SAC) (*1).
Bio-geographic importance	<ul style="list-style-type: none"> An area that either contains rare biogeographic qualities or is representative of a biogeographic 'type' or types, or contains unique or unusual biological, chemical, physical or geological features (PSSA).
Representativeness	<ul style="list-style-type: none"> An area that is an outstanding and illustrative example of specific biodiversity, ecosystems, ecological or physiographic processes, or community or habitat types or other natural characteristics. (PSSA).
Representativity	<ul style="list-style-type: none"> Degree of representativity of the natural habitat type on the site (SAC) (*2).
Representative natural ecosystems	<ul style="list-style-type: none"> Natural ecosystems which are underrepresented in protected area networks (OECM).
Proportion of the total population	<ul style="list-style-type: none"> Size and density of the population of the species present on the site in relation to the populations present within national territory (SAC).

Table 2 (continued)

Criterion	Description
Relative area of habitat type	<ul style="list-style-type: none"> Area of the site covered by the natural habitat type in relation to the total area covered by that natural habitat type within national territory (SAC).
Support of 1 % of individuals in a population of one species or subspecies	<ul style="list-style-type: none"> Wetland should be considered internationally important if it regularly supports 1 % of the individuals in a population of one species or subspecies of waterbird (Ramsar). Wetland should be considered internationally important if it regularly supports 1 % of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species (Ramsar).
Dependency	<ul style="list-style-type: none"> An area where ecological processes are highly dependent on biotically structured systems (e.g. coral reefs, kelp forests, mangrove forests, seagrass beds). Such ecosystems often have high diversity, which is dependent on the structuring organisms. Dependency also embraces the migratory routes of fish, reptiles, birds, mammals and invertebrates (PSSA).
Structural complexity	<ul style="list-style-type: none"> An ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms (VME).
Ecological integrity	<ul style="list-style-type: none"> A condition that supports intact species assemblages and ecological processes in their natural state, relative to an appropriate historical benchmark and characterised by contiguous natural habitat with minimal direct industrial anthropogenic disturbance. Ecological integrity identifies sites that contribute significantly to the global persistence of wholly intact ecological communities with supporting large-scale ecological processes (KBA).
Naturalness	<ul style="list-style-type: none"> Area with a comparatively higher degree of naturalness due to the lack of or low level of human-induced disturbance or degradation (EBSA). An area that has experienced a relative lack of human-induced disturbance or degradation (PSSA).
Integrity	<ul style="list-style-type: none"> An area that is a biologically functional unit, an effective, self-sustaining ecological entity (PSSA).
High level of ecological integrity or intactness	<ul style="list-style-type: none"> Areas with a high level of ecological integrity or ecological intactness, which is characterised by the occurrence of the full range of native species and supporting ecological processes. These areas will be intact or being restored under the proposed management regime (OECM).
Degree of conservation of structure and function	<ul style="list-style-type: none"> Degree of conservation of the structure and functions of the natural habitat type concerned and restoration possibilities (SAC). (*3)
Degree of conservation of features important for species survival	<ul style="list-style-type: none"> Degree of conservation of the features of the habitat which are important for the species concerned and restoration possibilities (SAC).
Productivity	<ul style="list-style-type: none"> Area containing species, populations or communities with comparatively higher natural biological productivity (EBSA).

(continued on next page)

Table 2 (continued)

Criterion	Description
Importance for threatened, endangered or declining species and/or habitats	<ul style="list-style-type: none"> An area that has a particularly high rate of natural biological production as the net result of biological and physical processes which increase the biomass in areas such as oceanic fronts, upwelling areas and some gyres (PSSA).
Threatened biodiversity	<ul style="list-style-type: none"> Area containing habitat for the survival and recovery of endangered, threatened or declining species or area with significant assemblages of such species (EBSA). Identifies sites contributing significantly to the global persistence of threatened species or threatened ecosystem types. Assessed through globally standardised methodologies as having a high probability of extinction (species) or collapse (ecosystems) in the medium-term. Threatened species are those assessed as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) according to The IUCN Red List of Threatened Species™ [32] (KBA).
Vulnerable, endangered, or critically endangered species or threatened ecological communities	<ul style="list-style-type: none"> Wetland should be considered internationally important if it supports vulnerable, endangered or critically endangered species or threatened ecological communities (Ramsar). (*4)
Rare, threatened or endangered species and ecosystems	<ul style="list-style-type: none"> Rare, threatened or endangered species and habitats and the ecosystems that support them, including species and sites identified on the IUCN Red List of Threatened Species, Red List of Ecosystems or national equivalents (OECM).
Fragility	<ul style="list-style-type: none"> An ecosystem that is highly susceptible to degradation by anthropogenic activities (VME). An area that is highly susceptible to degradation by natural events or by the activities of people. Biotic communities associated with coastal habitats may have a low tolerance to changes in environmental conditions, or they may occur close to the limits of their tolerance (e.g., water temperature, salinity, turbidity or depth). Such communities may be exposed to natural stresses such as storms or other natural conditions (e.g., circulation patterns) that concentrate harmful substances in water or sediments, that have low flushing rates and/or oxygen depletion. Additional stress may be caused by human influences such as contamination and changes in salinity. Thus, an area already subject to natural and/or human stressors may require special protection from further stress, including that from international shipping activities (PSSA).
Vulnerability, fragility, sensitivity, or slow recovery	<ul style="list-style-type: none"> Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery (EBSA).
Life-history traits of component species that make recovery difficult	<ul style="list-style-type: none"> Ecosystems that are characterised by populations or assemblages of species with one or more of the following characteristics: slow growth rates, late age of maturity, low or unpredictable recruitment or long-lived (VME).
Importance for ecological connectivity	<ul style="list-style-type: none"> Areas of importance for ecological connectivity or that are important to

Table 2 (continued)

Criterion	Description
Site role as part of an ecosystem	<p>complete a conservation network within a landscape or seascape (OECM).</p> <ul style="list-style-type: none"> Relationship of the site to migration routes or its role as part of an ecosystem on both sides of one or more European Community frontiers (SAC). (*5)

Notes:

*1 This criterion may be interpreted as an approximate measure of the contribution of a given population to the genetic diversity of the species on the one hand and of the fragility of this specific population on the other hand; i.e. the more a population is isolated (in relation to its natural range), the greater is its contribution to the genetic diversity of the species. Consequently, the term 'isolation' should be considered in a wider context, applying equally to strict endemics or to sub-species/varieties/races as well as sub-populations of a meta-population [33].

*2 Representativity is the degree to which a given habitat corresponds to a described type, including not only the most typical form of the habitat, but also its main variations [34]. EU Member States should consider 'the degree of representativity of Annex I habitat types on individual sites, ... [and] take account of the best examples in extent and quality of the main type, ... and its main variants, having regard to geographical range'. Ideally, this should result in a suite of sites for each Annex I habitat which covers the geographical and ecological range of variation present in the territory of the Member State [35] and references therein].

*3 Habitat structure and function involve several interrelated components. Structure implies conditions at one time including biotic and abiotic features such as biotic assemblage complement, habitat condition, morphology and topography/bathymetry. Function refers to rate processes and interactions such as energy balance, biogeochemical cycles, hydrogeomorphological changes [34].

*4 Ramsar sites are central to conserving globally threatened species and ecological communities. General Objective 2.2 of the Strategic Framework urges Contracting Parties 'to seek to include in the Ramsar List wetlands that include threatened ecological communities or are critical to the survival of species identified as vulnerable, endangered or critically endangered under national endangered species legislation/programmes or within international frameworks such as the IUCN Red Lists or Appendix I of CITES and the Appendices of CMS (2020) [36].

*5 This was the only criterion used here from stage 2 site selection for SAC designation. The other criteria are more vague and are relative in that they have to be compared to other sites a biogeographical level. These include the relative value of the site, total area and number of Annex I habitat types and Annex II species. This stage is to be carried by the European Commission.

between the designations. It is of note that none of the criteria in the designations indicate maximum or minimum sizes of the areas designated.

The features collated in Table 2 (from Tables S1a-h) were then interrogated to determine synergies, overlaps, duplications and redundancies between the designations. They show that each designation uses a variety of ecological and biological criteria and terminologies to identify areas of conservation importance. However, the same terms are often used with different meanings, while different terms may refer to the same concept. Therefore, to address major overlaps and repetitions, the 39 individual criteria in Table 2 from all the designations were reviewed, summarised and grouped into 13 main overarching criteria (Table 3). Table 3 was derived from the wording of the 39 criteria, which was interpreted to illustrate underlying similarities in meaning, even if the precise, original wording differed. The reasoning behind the grouping was mainly ecological but also methodological (for example, Proportional significance). Overall, this grouping highlights the core criteria inherent within the different designations. Conversely, some criteria could fit into multiple categories. For example, the criterion 'Isolation of the species population' is a measure of the contribution of a given population to the genetic diversity of the species and provides

Table 3

Criteria grouping of the 39 original criteria into 13 summarised ones based on their wording and including the rationale for grouping the criteria.

Original Criteria	New grouped criteria/categories	Rationale
Biodiversity/Biological diversity Site supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations Uniqueness or rarity Representative, rare or unique wetland types Irreplaceability	Biological diversity Uniqueness, rarity or irreplaceability	Criteria identifying areas with higher levels of biodiversity. Criteria emphasising the protection of unique, rare and irreplaceable species, habitats or ecosystems, whose loss would lead to permanent biodiversity decline or significantly reduce conservation options.
Importance for life-history stages of species Critical habitat Biological processes Spawning or breeding grounds Functional significance of the habitat Site regularly supports 20,000 or more waterbirds Geographically restricted biodiversity Range-restricted species and ecosystems in natural settings Isolation of the species population	Critical habitats and life-history processes Geographically restricted biodiversity Isolation of the population	Criteria identifying areas and habitats that are essential for key life-history stages, survival and reproduction of species. Criteria identifying sites crucial for the persistence of biodiversity features with limited geographical ranges Criterion identifying the contribution of a given population to the genetic diversity of the species Criteria identifying representative examples of ecosystems, habitats or natural features that maintain the full ecological and geographical range of variation within a given biogeographic region, or that are underrepresented in protected area networks.
Bio-geographic importance Representativeness Representativity Representative natural ecosystems	Representativeness	Criteria identifying representative examples of ecosystems, habitats or natural features that maintain the full ecological and geographical range of variation within a given biogeographic region, or that are underrepresented in protected area networks.
Proportion of the total population at the site Relative area of habitat type Support of 1 % of individuals in a population of one species or subspecies Dependency Structural complexity	Proportional significance Structural complexity	Criteria identifying areas that support a significant proportion of a population, habitat type, or species, thereby maximising the potential conservation effectiveness of the designation. Criteria identifying ecosystems where ecological processes and biodiversity depend on the physical complexity, including biotic structures, of the environment.
Ecological integrity Naturalness Integrity High level of ecological integrity or intactness	Naturalness and ecological integrity	Criteria identifying areas that maintain ecological processes, species assemblages and habitat structures with minimal level of human-induced disturbance, reflecting

Table 3 (continued)

Original Criteria	New grouped criteria/categories	Rationale
Degree of conservation of habitat and function and restoration possibilities Degree of conservation of features important for species survival Productivity	 Productivity	high levels of ecological functionality, intactness and potential for conservation or recovery. Criterion identifying areas with comparatively high natural biological productivity, driven by biological and physical processes that enhance biomass production.
Importance for threatened, endangered or declining species and/or habitats Threatened biodiversity Vulnerable, endangered, or critically endangered species or threatened ecological communities Rare, threatened or endangered species and ecosystems Fragility Vulnerability, fragility, sensitivity, or slow recovery Life-history traits of component species that make recovery difficult	Threatened biodiversity Vulnerability, fragility, sensitivity, or slow recovery	Criteria identifying critical areas for the survival, recovery or persistence of species, communities or ecosystems at the risk of extinction or collapse. Criteria related to ecosystems that are highly susceptible to degradation, characterised by sensitive habitats or slow recovery rates, or species with life-history traits that make recovery difficult.
Importance for ecological connectivity, as part of a network of sites in a landscape or seascape Site role as part of an ecosystem	Ecological connectivity	Criterion identifying areas that contribute to forming a cohesive network that enables ecological connectivity.

insight into the fragility of this specific population. In such cases, the criterion was assigned to the group that seemed the most appropriate based on their descriptions.

5. Comparative analysis of the conservation designations

Using the groupings given in Table 3, the criteria for each designation were then cross-tabulated to show the similarities between the designations (Table 4). The matrix used a presence-absence recognition of the criteria and, in the case of criteria fitting multiple categories, or with implicit principles where no specific criteria are applied (i.e. SPA designation), the criteria were assigned to all relevant categories. The matrix illustrated in Table 4 shows that the new criteria categories 'Uniqueness, rarity or irreplaceability' and 'Critical habitats and life-history processes' are used by all conservation designations. The Natura 2000 protected areas network designation includes the highest number of categories, while VME includes the fewest.

The matrix was then subject to a hierarchical cluster analysis in both Q and R-mode, i.e. to indicate respectively the similarities between the designations (cases) according to their criteria (attributes), and conversely the similarity between the attributes (criteria) according to which cases (designations) they belong (e.g. [37]). The analysis was performed in R [38] using a Jaccard dissimilarity matrix with Ward's minimum variance method [39]. The cluster analysis diagrams resulting from these two modes are given respectively in Figs. 1 and 2.

The Q-mode clustering of the designations (Fig. 1) reflects the two groups, each with similar criteria of the designations within the groups – Group 1 - Natura2000/OECM/KBA, and Group 2 - VME/Ramsar/EBSA/PSSA. Notably, the first group encompasses designations with a broader

Table 4

Matrix showing the summarised 13 new grouped criteria/categories present in designating the conservation areas. Shaded cells indicate the presence of a feature. Lighter cells indicate categories where criteria were not primarily assigned, either due to implicit principles where no specific criteria are applied, or because they fit into multiple categories. All cells were treated equally; 'Implicit principles' are given in the case of SPAs, that do not have explicit criteria (Table S1g).

	EBSA	VME	PSSA	OECM*	KBA	Ramsar	Natura 2000
Biological diversity							
Uniqueness, rarity or irreplaceability							
Critical habitats and life-history processes							
Geographically restricted biodiversity							
Isolation of the population							
Representativeness							
Proportional significance							
Structural complexity							
Naturalness and ecological integrity							
Productivity							
Threatened biodiversity							
Vulnerability, fragility, sensitivity, or slow recovery							
Ecological connectivity							

* Note that the OECM designation is being compared solely on the basis of their biodiversity criterion (i.e., 'The area achieves sustained and effective contribution to in situ conservation of biodiversity'), using the biodiversity attributes provided by the CBD (2018) guidance.

scope (e.g. that include terrestrial areas), whereas the second group includes all the conservation designations that are exclusively related to aquatic environments. The main categories unique to Group 1 are 'Geographically restricted biodiversity' and 'Ecological connectivity'. Group 2 includes all the focus-specific designations: Ramsar, which is habitat-specific, and VMEs and PSSAs, which are sector-specific.

The R-mode clustering of the criteria according to into which designations they apply (Fig. 2) indicate that there are 3 main groups: Group 1 comprising 'Geographically restricted biodiversity', 'Ecological connectivity', 'Isolation' and 'Proportional significance'; Group 2 including 'Vulnerability', 'Uniqueness', 'Critical habitats', 'Representativeness', 'Naturalness' and 'Threatened biodiversity', and Group 3 comprising 'Biological diversity', 'Structural complexity' and 'Productivity' of the areas. Group 2 aggregates the categories that are most frequently used across designations, while Groups 1 and 3 include categories that are less commonly applied. Group 1 focuses more on categories related to the spatial distribution and demographic aspects of biodiversity, while Group 3 emphasises ecological attributes such as diversity, structure and functional capacity of ecosystems.

6. Discussion

6.1. Criteria similarities and overlaps

The analysis and interpretation here indicate both the breadth of criteria and their similarity across the analysed marine nature conservation designations. Despite the differences in the terminologies used, there are many overlaps and shared features among the criteria used by the different conservation designations, such that the 39 individual criteria could be grouped into 13 criteria categories.

Among all the criteria categories, uniqueness, rarity or irreplaceability and critical habitats and life-history processes appear to be the most usual criteria due to their frequency of use across designations. These findings partly differed from Asaad et al. (2016) [40], that identified eight ecological criteria commonly used by international initiatives across terrestrial, freshwater and marine environments to identify areas important for biodiversity conservation. However, as the current study focused specifically on the marine environment, differences emerged in the most frequently used criteria across designations, with

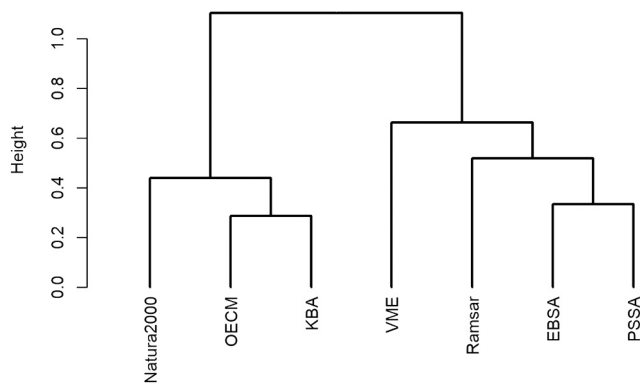


Fig. 1. Hierarchical cluster analysis (Q-mode) showing the similarities between the conservation designations based on the criteria used to select areas of conservation importance. (NB the height scales indicate distance between clusters. Height represents the level of dissimilarity, or distance between clusters, i.e. the lower the height, the more similar the cluster designations.).

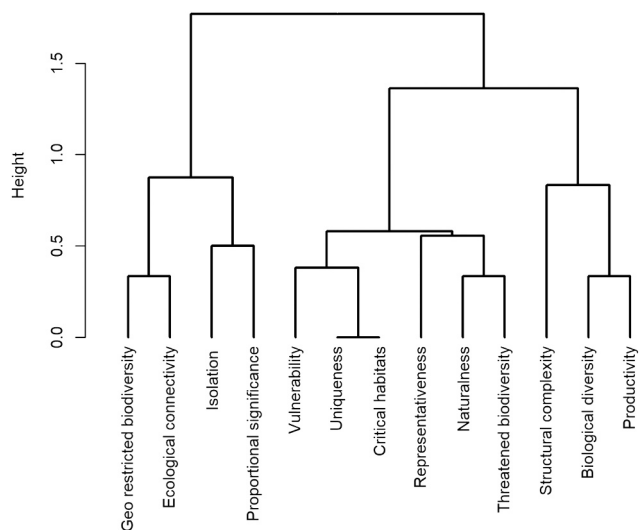


Fig. 2. Hierarchical cluster analysis (R-mode) showing the similarities between criteria according to the designations in which they are adopted.

the exception of ‘critical habitats and life-history processes’ which ranked as one of the most commonly-cited criteria in both analyses.

The analysis here has shown that the analysed area-based conservation designations and Area Based Management Tools (ABMT) can be separated into two groups based on the similarities in their criteria and attributes. Designations originating from different sectoral global organisations such as FAO, IMO and CBD, show similarities based on their criteria. The differences in terminologies used across these designations for similar criteria can be attributed to the fact that they have been established by delegates with different backgrounds and priorities to address different demands at different times. These criteria will also have varying objectives and sometimes targeting different sectors (e.g., VMEs for fisheries and PSSAs for shipping and navigation) or habitats (e.g. Ramsar) and operating within different institutional settings [7,41]. While the groupings were based on similarities in the criteria, which were considered to outweigh their differences, it is also recognised that these differences might result from distinct scientific considerations that have an impact on how the criteria are applied in terms of monitoring and management.

Conversely, designations originating from the same source did not necessarily show similarity. For example, although both OECM and EBSA ecological criteria originate from the CBD [14], they were not

grouped together according to their attributes. Despite this, these two designations (as well as others such as PSSA) require a minimum of one criterion for an area to qualify as having high conservation value. However, if an OECM candidate site is already formally recognised as an area important for biodiversity – such as a key biodiversity area (KBA) or an ecologically or biologically significant marine area (EBSA) – it can be assumed that at least one of the criteria was used to identify the site contribution to *in situ* conservation of biodiversity. It is notable that, as of February 2023, 29.3 % of reported OECMs overlapped with a KBA, providing protection to these areas [42]. OECMs also provide coverage to EBSAs [42], but in this case, to a lesser extent than with KBA, this is probably the result of there being fewer marine OECMs compared to terrestrial OECMs. All of the criteria and designations require interpretation by the users and implementers which again reduces the distinction between them; for example, the Natura 2000 sites SAC and SPA designated by EU states have poorly-defined criteria as befitting the fact that they are created by framework directives (respectively the Habitats & Species and the Wild Birds Directives). Under the process of subsidiarity, a Framework Directive is implemented by Regulations with discretion by those Member States [43]. This in turn leads to the possibility of reducing coherence between adjacent Member States although there would be equivalence as long as the same outcomes were achieved by those states; coherence is using the same methods to give the same outcomes in different areas whereas equivalence is using different methods but to achieve the same outcomes [24].

Overlaps in protected areas commonly occur worldwide, with under a fifth of the global marine network being protected by two or more designations [44]. Consequently, overlaps in the ecological criteria used to identify areas of high conservation value were to be expected. Moreover, the fact that at least six of the conservation designations assessed here require only a minimum of one criterion for an area to qualify as having high conservation value further increases the similarity (and hence redundancy) between designations. At a national level, Schéré et al. (2020) [45] found that sites with multiple designations were more likely to have management plans and, to a lesser extent, favourable conservation outcomes. While multiple designations of a site might be beneficial (e.g., when a site is recognised under designations with a different focus such as ecological or cultural), it also introduces the risk of conflicting management objectives or governance structures [44,46].

6.2. Challenges of criteria terminology

The different terminologies used for equivalent criteria across the different designations may further hinder effective communication among the several levels of governance and management; this can lead to inefficiencies or misalignment of goals or even creating redundancies in efforts [24,47]. Differences in terminologies and their implementation may also increase the variability in the way criteria are applied, thereby reducing the coherence and/or equivalence between adjacent countries [24]. For example, Asaad et al. (2016) [40] identified five biodiversity variables necessary to measure eight criteria commonly used to identify areas for biodiversity conservation in the terrestrial, freshwater and marine realms. The lack of consistency in terminology and the use of multiple designations and approaches can lead to confusion amongst stakeholders, from researchers to policymakers and to the public, compromising effective engagement in conservation efforts [48]. Hence, harmonising terminologies or developing cross-references between equivalent criteria could enhance clarity and coherence across designations, ultimately improving the efficiency and effectiveness of marine conservation efforts. An example of establishing explicit cross-references across designations is provided by ICES (2023) [49], which visualised the links that can be drawn between individual criteria for EBSAs, and the biodiversity attributes of OECMs and VMEs, showing the comparability of equivalent criteria across frameworks. It is emphasised here that countries have agreed under the Convention for

Biological Diversity (CBD) to achieve the so-called 30 × 30 target, i.e. 30 % of protected areas by 2030 with 10 % under strict protection. Accordingly, for such a network to enhance ecological functioning rather than just support ecological structure, the dynamic nature of marine areas requires countries to create a coherent network of protected areas [2,23]. This in turn requires focussed guidance to ensure comparability in geographical areas, at least within national boundaries and, if possible, between such country boundaries [50]. Hence, countries are combining several designations in order to fulfil the above target, as so-called *de facto* MPAs which are incidentally networked to give nature conservation benefits (e.g. [51,52]).

6.3. Connectivity and size as criteria

Ecological spatial connectivity is fundamental to marine nature conservation [5,24,53], yet conservation designations have been often applied to individual sites rather than as a network [54]. When targeting species with long-distance dispersal, as typical for many marine invertebrates and fish, connectivity may be more important than habitat quality as a selection criterion for MPAs [55]. However, in examining 746 MPAs, Balbar and Metaxas (2019) [56] found that only 11 % were designed with connectivity as an ecological criterion. Similarly, only two of the conservation designations considered here explicitly include ecological connectivity in their criteria; in the case of Natura 2000, this is addressed during a secondary stage of the designation process, after the candidate area has been identified using other specific criteria.

It is emphasised here that without physical connectivity, then an area would be functionally deficient; for example, larvae from one area would be prevented from maintaining the adult population in a receiving area [24,57]. Thus, marine conservation areas need to be managed across networks allowing for transboundary features, e.g. one area may only function satisfactorily because of its relationship with another and marine management is required to achieve similar outcomes across regions; hence the importance of achieving connectivity, coherence and/or equivalence across boundaries [24]. Regulatory frameworks, such as the EU Marine Strategy, the Marine Strategy Framework Directive (MSFD), the implementation of maritime spatial planning and the EU Maritime Spatial Planning Directive (MSPD), implicitly or explicitly require countries to achieve a coherent network [23]. This may involve physical connectivity, to create sustainable populations, for example where a breeding population produces larvae migrating and settling after metamorphosis to maintain another area. However, a coherent network may just require suitable conditions for a species or habitat to occur and management measures at areas which are not physically connected (see also [47,58]).

The above discussion emphasises that marine nature conservation should operate at larger scales, especially across national boundaries. The Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) exemplifies one approach to designing protected area networks [59]. Contracting Parties nominate MPAs, and candidate sites must meet specific ecological and practical selection criteria [60]. The ecological criteria are similar to those examined here and include: important species and habitats/biotopes, ecological significance, high natural biological diversity, representativity, sensitivity and naturalness. OSPAR MPA candidates are often already covered by other designations (e.g., [12]) and therefore have already been evaluated against similar selection criteria. Hence, subjecting these areas to additional, overlapping criteria may lead to redundancy of effort.

It is also of note that none of the criteria in the designations considered indicate maximum or minimum sizes of the areas designated. This reinforces that criteria are more concerned with ecological structure (i.e. what is in an area) rather than ecological functioning (the rate processes and especially the area necessary to have a functioning system). The size is then left to site managers or to nation states wishing to achieve a given target value, e.g. 30 % protected area by 2030 [19,60].

Within this target, countries are required to give additional protection to 10 % of the area and hence are discussing areas which are ‘highly protected marine areas’, ‘strongly protected’, ‘strictly protected’, ‘fully protected’ etc. In these, most or all activities should be prohibited, thereby possibly having severe economic repercussions (e.g. [61]); it is emphasised that these terms require clarity, not least between countries. However, recent prohibitions of bottom trawling in protected areas shows the importance of a top-down application by governments rather than individual site management [62].

In attempting to reach such targets for protection, countries may include all designations both as Marine Protected Areas and *de facto* MPAs, such as OECMs, and other Area Based Management Tools described here (SACs, SPAs, etc.) [2,63]. As an example of the potential for designating a given size and shape of protected areas, the UK used such criteria in designating Marine Conservation Zones, i.e. *de facto* Marine Protected Areas [50]. The MCZ were designed using a stakeholder-led process according to official Ecological Network Guidance [50,64] to focus on creating a coherent network covering representativeness and replication. This guidance also required the sites to be of a sufficient size to function appropriately and also having the most simple shape configuration (i.e. the minimum number of sides ≥ 3).

6.4. Enhancing the integration of nature conservation designations

The analysis here suggests that any designation or network which includes all of the 13 high level criteria would be comprehensive and hence achieve the ultimate aim of protecting all natural aspects. However, data to support all the criteria may be difficult to obtain [65] and therefore an optimum set of criteria should be used to meet the requirements of a conservation designation. Among the eight designations assessed here, all except Natura 2000 (SAC and SPA) designations require a single criterion for an area to qualify as having high conservation value. This suggests that any definition including many criteria but requiring only one to be fulfilled is merely a ‘catch-all’. It is also of note that some terms are inherently contradictory and therefore a conservation designation area could not be identified using all the criteria. For example, an ‘irreplaceable’ habitat would not meet the criterion of ‘representativeness’, which implies the habitat occurs in multiple areas. Similarly, an ‘isolated population’ by definition would not be ‘representative’ or be a part of a ‘connected network’ of sites (e.g. [23]).

Furthermore, in contrast to some designations, the criteria indicated here should be accompanied by a management and monitoring plan, to determine if the criteria are met and then an agreed programme of measures to achieve them if not met [66]. For example, the regulations for SAC and SPA require an Appropriate Assessment (AA) to be carried out in the case of any plan or project liable to affect the conservation designations for which the sites were designed, i.e. to prevent the area being in Favourable Conservation Status; the AA assesses the plan or project ‘at this place, at this time and carried out in this way’ (as with an Environmental Impact Assessment) [11]. For the case of EBAs, which do not in themselves imply management measures, their designation provides a valuable foundation to implementing practical spatial management measures [67], as evidenced by Harris et al. (2022) [58] who showed how EBSA identification can lead to the development of effective marine spatial management in developing-country settings. The lack of a suitable management plan underpinned by a monitoring procedure and quantitative targets and indicators has led to ABMT being labelled ‘paper parks’, i.e. ineffective. Similar, the term OECM reflects a measure designating an area but that measure (as an ‘effective’ management response) needs to be put in a Programme of Measures (*a la* the MSFD [66]). This process has been summarised as Systematic Conservation Planning [1 and references therein].

Finally, as a suggestion for further testing by practitioners, Box 1 provides a summarised overview of practical steps, as discussed in this section, that can be used to enhance the integration of existing conservation designations. If implemented, this would ensure a designated site

Box 1

Practical steps to enhance the integration of existing conservation designations.

Terminology harmonisation

- Clarify terms used within each designation to ensure consistency and reduce confusion among stakeholders

Guidelines for applying criteria

- Provide clear guidance on how to apply criteria across designations and enhance cohesion and consistent use of key terms

Identification of common variables

- Identify a minimum set of variables needed to inform equivalent criteria (following the approach of Asaad et al. [40])

Cross-referencing equivalent criteria

- Identify and link similar criteria across designations, creating cross-references that clarify overlaps, improve consistency and support coherent application of criteria.

Management and monitoring plans

- Develop management and monitoring plans to determine if the criteria are met and to incorporate assessment frameworks.

Programme of measures

- Establish a programme of measures to achieve the intended conservation outcomes

covers a biodiversity network with elements of uniqueness, rarity or irreplaceability, with critical habitats and life-history processes. It includes geographically restricted biodiversity and supports a significant proportion of the population. It may include isolated populations that contribute to the overall genetic diversity of the species or features representative of other areas. It encompasses structural complexity and naturalness or integrity, and supports threatened biodiversity and vulnerable, fragile, sensitive species or those of slow recovery. It shows functional features of productivity and enables connectivity across the seascape (between species and/or habitats) or at least coherence. Via coherence and/or equivalence, management should encompass the network of sites within a dynamic and often transboundary system.

7. Conclusions

It is concluded that if each designation had a restricted and particular set of criteria then there might be good reasons for having separate designations. However, with so many designations having several/many criteria, which do not all (or even very few) need to be fulfilled, then this increases the redundancy in multiple designations. The analysis here shows similarities between designations based on their criteria and hence it shows redundancy in terminology. The analysis indicates that there may be an element of sectoral proponents wishing unnecessarily to create a new and individual named designation irrespective of its similarity to other bodies and designations.

CRedit authorship contribution statement

Eva Amorim: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Conceptualization. **Michael Elliott:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of Competing Interest

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2025.106960](https://doi.org/10.1016/j.marpol.2025.106960).

Data availability

No data were used for the research described in the article.

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