Progress developing the concept of other effective area-based conservation measures

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Abstract
In 2010, the introduction of other effective area-based conservation measures (OECMs) into international policy caused a paradigm shift in area-based conservation, which included consideration of areas outside formal protected areas and places where biodiversity conservation may not be a management objective for the site. Despite the importance of this shift for global conservation, conservation science and policy have been slow to engage with the concept of OECMs. As the world moves toward protecting 30% of the Earth by 2030, it is imperative to develop evidence-based guidance for how to identify effective conservation measures, especially tools to help evaluate and monitor the biodiversity outcomes associated with potential OECMs. To understand the current progress in developing the concept of OECMs, I evaluated the peer-reviewed literature to consolidate and synthesize current knowledge. I conducted a thematic analysis of papers to identify the types of challenges and opportunities being discussed and lessons from studies evaluating the effectiveness of OECMs. Only 105 studies mentioned OECMs, and those that did rarely move beyond superficial mention of OECMs as part of area-based conservation. Around one-half of studies listed potential risks or benefits of OECMs but none provided evidence these issues have materialized. Twenty-three studies attempted to identify potential OECMs, although specific case studies were rare. The 7 studies that evaluated existing OECMs were highly critical of how they had been implemented to date. Studies that evaluated conservation outcomes were extremely rare, and suggested effectiveness must be judged on a case-by-case basis. The current literature not only leaves many gaps in the science required to operationalize the concept of OECMs, but also often raises additional questions that need to be addressed. If these gaps are not filled by robust science, the promised benefits for biodiversity from OECMs may never be realized.

KEYWORDS
Aichi Target 11, area-based conservation, Convention on Biological Diversity, global biodiversity framework, protected and conserved areas, protected areas, 30x30

Progreso en el desarrollo del concepto de otras medidas efectivas de conservación basadas en el área

Resumen: En 2010, la introducción de otras medidas eficaces de conservación basadas en zonas geográficas específicas (OECM) en la política internacional provocó un cambio de paradigma en la conservación basada en el área, que incluyó la consideración de zonas situadas fuera de las áreas protegidas formales y lugares donde la conservación de la biodiversidad puede no ser un objetivo de gestión para el sitio. A pesar de la importancia
de este cambio para la conservación mundial, la ciencia y la política de la conservación han tardado en comprometerse con el concepto de OECM. A medida que el mundo avanza hacia la protección del 30% de la Tierra para 2030, es imperativo desarrollar orientaciones basadas en pruebas sobre cómo identificar medidas de conservación eficaces, especialmente herramientas que ayuden a evaluar y supervisar los resultados de biodiversidad asociados a posibles OECM. Para comprender los avances actuales en el desarrollo del concepto de OECM, evalué la bibliografía revisada por pares para consolidar y sintetizar los conocimientos actuales. Realicé un análisis temático de los artículos para identificar los tipos de retos y oportunidades que se debatían y las lecciones extraídas de los estudios que evaluaban la eficacia de las OECM. Sólo 105 estudios mencionaron las OECM, y los que lo hicieron rara vez iban más allá de la mención superficial de las OECM como parte de la conservación basada en el área. Aproximadamente la mitad de los estudios mencionaron los riesgos o beneficios potenciales de las OECM, pero ninguno aportó pruebas de que estos problemas se hubieran materializado. Veintitrés estudios intentaron identificar OECM potenciales, aunque los estudios de casos fueron escasos. Los siete estudios que evaluaron las OECM existentes fueron muy críticos con la forma en que se habían aplicado hasta la fecha. Los estudios que evaluaban los resultados de la conservación eran muy escasos y sugerían que la eficacia debía juzgarse caso por caso. La bibliografía actual no sólo deja muchos vacíos en la ciencia necesaria para hacer operativo el concepto de OECM, sino que a menudo plantea cuestiones adicionales que deben abordarse. Si estos vacíos no se cubren con una ciencia sólida, es posible que los beneficios prometidos de las OECM para la biodiversidad nunca lleguen a materializarse.

PALABRAS CLAVE
áreas conservadas y protegidas, áreas protegidas, conservación basada en el área, Convención sobre la Diversidad Biológica, marco de la biodiversidad global, objetivo 11 de Aichi, 30 x 30

【摘要】
2010年，其他有效的区域保护措施（other effective area-based conservation measure, OECM）被纳入国际政策，引起了基于区域的保护的范式转变，其中包括考虑正式保护区之外的区域和不以生物多样性保护为目标地区的。尽管这一转变对全球保护非常重要，但保护科学和政策在推动OECM概念方面一直进展缓慢。随着全球朝向到2030年保护30%地球的保护目标迈进，目前急需为如何确定有效的保护措施制定基于证据的指导，特别是发展帮助评估和监测与潜在OECM相关的生物多样性结果的工具。为了了解目前在发展OECM概念方面的进展，研究者评估了同行评议文献，以巩固和综合现有的知识。本文对相关论文进行了专题分析，以确定目前正在讨论的挑战和机遇类型，以及从评估OECM有效性的研究中获得的经验教训。研究者发现，只有105项研究提到了OECM，且这些研究很少在提及OECM作为区域保护的一部分之外进行更深入的讨论。大约一半的研究列出了OECM的潜在风险或益处，但却没有一项研究提供实质性证据。有23项研究试图确定潜在的OECM，但案例研究很少。有7项研究对现有OECM进行了评估，但对迄今为止的实施方式提出了高度批评。此外，评估保护结果的研究十分稀缺，而它们提出建议的有效性必须根据个案情况来具体分析。已有文献不仅在实施OECM概念所需的科学基础方面存在许多空白，而且还经常提出需要解决的额外问题。如果没有可靠的科学研究来填补这些空白，那么OECM所承诺的对生物多样性的好处可能永远无法实现。【翻译：胡怡思；审校：聂永刚】

关键词：爱知目标11，基于区域的保护，《生物多样性公约》，全球生物多样性框架，保护区与保护成效区，保护区，30 x 30

INTRODUCTION

In the midst of extinction and climate crises, the world is looking for novel solutions to prevent catastrophe. Protected areas (PAs) have long been the primary conservation strategy, yet bio-
diversity continues to decline, even as the number of PAs and the total area protected has increased (Maxwell et al., 2020).

In response, there have been bold calls to expand protection beyond the previous more modest goals of 17% of land and 10% of sea included in the Convention on Biological Diversity
The keyword "OECMs" was included because it is used as a synonym for inland water, and of coastal and marine areas by 2030 (IUCN-WCPA, 2019). To date, just over 800 OECMs have been formally registered across 9 countries, accounting for approximately 1.3% of the total area protected (Protected Planet, 2023). Yet, there has been little transparency about whether these areas genuinely meet the criteria to be OECMs. The lack of progress may be the result of a lack of evidence to effectively support countries to implement OECMs at scale. Such an evidence base could come in the form of case studies documenting the evaluation process used to register existing OECMs or by developing tools to screen potential OECMs across a range of contexts. Drawing on a broad evidence base could also help identify challenges that need to be resolved (e.g., how to monitor and report on in situ conservation outcomes), highlight benefits or unintended consequences of implementing OECMs, and provide a valuable blueprint for countries that have not yet explored the role OECMs could play in area-based conservation.

A more ambitious target for area-based conservation needs robust safeguards to ensure the intended benefits for biodiversity are delivered. Studies exploring the risks and benefits associated with OECMs could identify unintended consequences that require safeguards, but could also highlight the reasons why countries may want to support recognition of OECMs. To help countries make real progress toward the 30×30 CBD target, it has never been more important for conservation science to build a diverse and robust evidence base. Science has a critical role to play in helping advance the concept of OECMs and in addressing outstanding questions, the answers to which will enable OECMs fulfil their promise (Dudley et al., 2018; Gurney et al., 2021).

To support this goal, I reviewed the peer-reviewed literature on OECMs and synthesized lessons that could help progress effective implementation of this concept in practice. Specifically, I sought to collate studies addressing OECMs and identify the relevant concepts and contexts they discuss; identify the potential risks and benefits associated with the concept of OECMs; identify tools and synthesize lessons that could help support the identification of potential OECMs; and capture findings from studies that evaluate the effectiveness of existing OECMs. Consolidating lessons from the conservation literature in this way can help reveal critical gaps in the science and set a research agenda that can support countries implement OECMs as a tool for effective broadscale conservation.

**METHODS**

**Search strategy**

Peer-reviewed literature discussing the concept of OECMs was identified using the keywords "other effective area-based conservation measure" OR "OECM" OR "conserved area". The keyword "conserved area" was included because it is used as a synonym for...
OECMs, often in the phrase *protected and conserved areas*, when discussing PAs and OECMs (e.g., Green List of Protected and Conserved Areas [IUCN-WCPA, 2017]).

Searches were conducted in Web of Science Core Collection on 15 December 2021 (title, abstract, keywords, keywords plus) and in the database Scopus on 30 May 2022 (title, abstract, keywords fields; limited to papers published before 2022). Searches were not limited to papers published in English, but studies did require an abstract in English to be included in the full text screening stage. I did not search the gray literature, which may contain additional information about OECMs not present in the peer-reviewed literature.

Once duplicates were removed, the title and abstract of each paper were screened to identify potentially relevant papers. Any paper that mentioned OECMs or conserved areas in the context of conservation or environmental science was retained, and the reasons for excluding any study were recorded. The remaining articles were read in full.

### Data extraction

Each of the relevant studies was classified according to whether it was identified by the term *OECM* or *conserved area* and whether the term *OECM* was subsequently used in the full text. Papers that used *OECM* were classified according to how the term was used. Papers were coded based on the level of detail with which they discussed the concept of OECMs (Table 1) in recognition that some papers only mention OECMs once or provide a very superficial treatment of the concept in papers about other topics. For example, papers identified because they included the text of Aichi Target 11. Other studies offered a detailed discussion of OECMs or had OECMs as the focus of the paper. Although some data were extracted from papers that offered a superficial treatment of OECMs, I report these results separately to distinguish them from papers offering a substantial discussion (Table 1).

To understand the diversity of contexts, the geographic location of studies was recorded, along with whether they were focused on the marine or terrestrial realm. When the discussion of OECMs did not reference their application around the world, papers were classified as a general discussion. Studies with no country or region as the focus of the discussion were classed as international. For all other studies, relevant countries were recorded, including whether they focused on multiple countries in a region or concentrated on a single country or portion of a country (specific focus).

To understand how OECMs were being discussed in the literature, mention of the potential benefits of OECMs was recorded. Benefits were grouped into similar themes with an inductive approach (Patton, 2002). Again, the depth of discussion was recorded, which separated studies that provided a superficial treatment of potential benefits (e.g., noted the potential for unspecified benefits or listed examples without further discussion) and studies that provided a more substantive discussion of benefits. The same process was used to identify and group potential risks associated with OECMs and code the level of detail with which studies discussed those risks. The results for studies with only a superficial treatment are reported separately from those offering an in-depth discussion.

### Thematic analyses

To understand how the literature has contributed to developing the concept of OECMs, I conducted a thematic analysis of studies offering a substantial discussion of OECMs (Table 1). This analysis focused on whether studies were conceptual in nature (i.e., commentary about OECMs) or a direct discussion of potential or existing OECMs. Commentary papers were further analyzed to assess the key themes discussed therein. Where studies focused on the application of OECMs, I considered whether they developed novel criteria or tools, or critiqued existing criteria or tools used to screen potential OECMs. This

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**TABLE 1** Classification of the level of detail with which studies discussed the concept of other effective area-based conservation measures (OECMs).*

<table>
<thead>
<tr>
<th>Level of discussion</th>
<th>Description</th>
<th>Number of studies</th>
</tr>
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<tbody>
<tr>
<td>Superficial treatment of OECMs</td>
<td>Paper not about OECMs but term <em>OECM</em> used in the paper; includes papers about protected areas that say their findings could also be relevant to OECMs</td>
<td>38</td>
</tr>
<tr>
<td>Brief mention</td>
<td>Small section of paper discusses OECMs, generally in relation to protected and conserved areas, but discussion actually focused on protected areas rather than OECMs</td>
<td>27</td>
</tr>
<tr>
<td>Minor discussion</td>
<td>Paper exclusively about OECMs; includes developing or applying a framework to screen potential OECMs, providing detailed discussion of risks and benefits or evaluation of specific OECMs</td>
<td>16</td>
</tr>
</tbody>
</table>

*Includes 93 studies that used the term OECM and 12 studies that used conserved area as a synonym for OECM (total 105 studies).
was done to capture whether authors were pointing to deficiencies, or filling gaps in existing frameworks, and whether authors were positive or critical of existing tools. I recorded whether studies focused on potential or existing OECMs to see what could be learned about how OECMs are currently used and could be used in future. I noted whether studies provided data from specific case studies or used criteria to screen broad types of conservation areas, thereby contributing to understanding the practicalities of screening sites across contexts. Studies that attempted to evaluate the effectiveness of conservation outcomes in existing or potential OECMs were specifically noted, which could offer valuable guidance about how groups could or should demonstrate that sites meet the relevant criteria.

RESULTS

The search identified 333 potentially relevant papers, of which 100 used the term other effective area-based conservation measure or OECM somewhere in the title, abstract, keywords, or main text (Figure 1). Twenty-eight of these papers were identified only through the term conserved area. An additional 12 papers did not use OECMs anywhere but instead used conserved area as a synonym for OECMs (e.g., protected and conserved areas). In total, 112 papers discussed the concept of OECMs, even if not directly using the term, whereas 221 mentioned conserved area in a different context (e.g., natural areas). We excluded 7 papers that used OECMs only in the context of Aichi Target 11. Therefore, data were extracted from 105 studies.

The number of potentially relevant papers increased significantly over time, largely driven by an increase in papers mentioning conserved areas (Figure 2). The first paper to mention OECMs was in 2012 (2 years after the concept was introduced). The number of papers increased slowly at first and then sharply after the IUCN published a definition in 2018 (Figure 2). The phrase protected and conserved areas emerged in the literature in 2015 and was used in 59 papers, but the majority of these papers (40) also used OECM somewhere in the text. The prevalence of protected and conserved areas has kept pace with the increasing use of OECM (Appendix S1).

Geographic focus

Papers were relatively evenly distributed between exclusively discussing OECMs in the marine (33) or terrestrial realms (33) (Figure 3) versus those not focused on a specific realm (39). Studies with a specific geographic focus were less common than those with an international focus (33) or those offering a more generic discussion of OECMs (28). Of the 45 papers with a geographic focus, only 21 included a substantial discussion of OECMs. These papers considered 20 countries and 3 general regions (Figure 3). A single study addressed OECMs across 10 countries (Donald et al., 2019) (Table 2). Ten country-specific studies focused on Canada; all but 2 of these focused on OECMs in the marine realm (Table 2). There was no evidence that studies were more likely to focus on countries where current levels of protection were low. Rather, countries...
being examined in the literature tended to be closer to meeting their post-2020 targets than other countries around the world (Appendix S2). Five of the 9 countries that have already registered OECMs (Canada, Colombia, Peru, South Africa, and Philippines [Protected Planet, 2023]) were mentioned in at least 1 study (Table 2).

**Risks and benefits of OECMs**

Almost one-half (49%) of the 105 papers commented on the potential benefits of OECMs; risks were touched on in around one third of papers (32%). Just over a quarter of studies (27%) mentioned both the potential risks and benefits of OECMs as a concept. I present a snapshot of the types of risks and benefits mentioned by papers, even if papers only provided a superficial treatment of OECMs. By far the most common potential benefit was that OECMs could expand the area protected and complement existing PAs (Figure 4a; Appendix S3). Other benefits mentioned were related to OECMs playing a role in increasing connectivity and ecological representation of area-based conservation and formally recognizing areas that already benefit biodiversity (Figure 4a). Even in papers specifically addressing OECMs, it was common for discussion of benefits to be a superficial (e.g., only listed or mentioned, 78%), rather than form part of a substantial discussion evaluating the factors that might contribute to realizing these benefits.

The perceived risks associated with OECMs were more diverse (Figure 4b; Appendix S3). Of the 36 studies that mentioned risks, 50% highlighted concerns that the lack of clarity around OECMs could lead to perverse outcomes for biodiversity conservation (Figure 4b). Approximately one third of studies raised concerns that OECMs may not genuinely protect important biodiversity and could even undermine or replace existing PAs (Figure 4b).

Benefits mentioned by some authors were considered to be potential risks by other authors. For example, the potential for OECM status to help attract additional resources and support capacity building was mentioned as a benefit (10), but a lack of resources was also seen as a risk to the ability of communities to identify, monitor, and report on conservation outcomes (7) (Figure 4). Only 2 studies discussed potential sources of additional resources, including the Global Environment Fund (Alves-Pinto et al., 2021), or the private sector and conservation donors (Gurney et al., 2021). Likewise, the prospect of positive conservation outcomes from OECMs was balanced by concerns about the challenges associated with ensuring the expected outcomes are realized (Figure 4).

**Thematic analyses**

Although all studies mentioned OECMs, the level of detail associated with studies varied considerably (Table 1); most (59%) offered a superficial treatment of the subject. Of these, 38 papers contained only a brief mention of OECMs in the keywords, abstract, or both or used the generic phrase protected and conserved areas (e.g., the IUCN Green List of Protected and Conserved Areas [IUCN-WCPA, 2017]). A further 24 included a minor discussion of OECMs as part of papers discussing topics, such as area-based protection targets, that made reference to the role OECMs may play in expanding the area protected in future (Table 1).

Forty-three studies made a substantial contribution to developing the concept of OECMs. The themes addressed by these papers included a conceptual discussion of what OECMs might

**FIGURE 2** The total number of articles or studies relating to other effective area-based conservation measures identified in each year after screening for relevance (dark green, all relevant articles; pale green, subset of articles that include the term other effective area-based conservation measures). The year OECMs were first introduced into the Convention on Biological Diversity (CBD) Target 11 (2010) and the year the definition was first published (2018) are indicated.
mean for area-based conservation (13); critique of the application of existing OECMs (7); and identification of potential OECMs (23).

Fourteen studies focused on area-based conservation and asked the question, what will OECMs mean for area-based conservation? All touched on the opportunities OECMs could present to expand protection for biodiversity or empower local communities. There was also a strong focus on the uncertainty about how to identify suitable areas (7) and concern that OECMs could be poorly implemented (9) (see “Risks and benefits” above).

Only 7 studies critiqued existing OECMs, and they all focused on their application in Canada (Table 2). These studies often used the IUCN criteria to argue that marine refuges (i.e., marine OECMs in Canada) (DFO, 2016) should not be recognized as OECMs because they permit industrial-scale resource extraction. Two of those studies conducted a detailed evaluation of an existing marine OECM, with a focus on evaluating whether it meets the criterion of providing benefits to biodiversity (see “Effectiveness” below).

Studies exploring potential OECMs (23) were diverse. Ten studies used a case study approach to screen specific sites. These included 2 studies evaluating individual sites (e.g., Diz et al., 2018; Echeverri et al., 2021) (Table 2). Studies that focused on multiple sites (6) ranged from small-scale assessments of 2 or 3 similar sites (e.g., complementary conservation strategies

FIGURE 3 Geographic distribution of studies that mention other effective area-based conservation measures (OECMs) in reference to a specific country: (a) number of studies per country and (b) whether studies focused on the marine (blue), terrestrial (green), or a mixture of both (purple) realms.
## Table 2: Studies that provide a substantial discussion of existing or potential other effective area-based conservation measures (OECM)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Case study or general discussion</th>
<th>Description of study contents</th>
</tr>
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<tbody>
<tr>
<td>Critiquing existing OECMs</td>
<td></td>
<td>Developed a series of ecological indicators and analyzed relevant monitoring data inside and outside Lophelia Coral Conserved Area in Canada to evaluate whether it would meet the criteria for in situ conservation of biodiversity</td>
</tr>
<tr>
<td>Beazley et al., 2021b&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Individual site</td>
<td>Canadian Fisheries and Oceans (DFO) operational guidance used to evaluate OECM status of the Disko Fan Conservation Area</td>
</tr>
<tr>
<td>Hiltz et al., 2018b&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Individual site</td>
<td>Argues that fisheries closures identified using the DFO operational guidance do not meet the criteria for OECMs as described by the International Union for the Conservation of Nature (IUCN)</td>
</tr>
<tr>
<td>Bothewey &amp; Cunningham, 2021&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Discussion</td>
<td>Describes deficiencies in Canadian Council on Ecological Areas (CCEA) operational guidance for OECMs; limited information on governance and management and ecosystem services; points to criticisms of fishery closures or marine refuges recognized as OECMs</td>
</tr>
<tr>
<td>Hubert &amp; Gray, 2020&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Discussion</td>
<td>Commentary on uncertainty in how the definition and guidance associated with OECMs create challenges for effective implementation; contrasts criteria for OECMs developed by the IUCN, DFO, and CCEA</td>
</tr>
<tr>
<td>Lemieux et al., 2019&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Discussion</td>
<td>Argues fisheries closures identified using DFO operational guidance do not meet the criteria for OECMs as described by IUCN</td>
</tr>
<tr>
<td>Lemieux &amp; Gray, 2020&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Discussion</td>
<td>Discusses DFO operational guidance and challenges associated with including fisheries closures as a form of OECM</td>
</tr>
<tr>
<td>Schram et al., 2019&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Discussion</td>
<td>Discusses site-level assessment of governance and equity (SAGE) framework to evaluate the effectiveness of sustained governance within the OECM definition; applied to assess potential OECMs in Colombia</td>
</tr>
<tr>
<td>Diz et al., 2018&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Individual site</td>
<td>Discusses role for Marine and Coastal Environmental Impact Assessment and Strategic Environmental Assessment Guidelines for identifying OECMs; suggests role for ecologically or biologically significant marine areas and vulnerable marine ecosystems criteria in screening potential OECMs; highlights particularly sensitive sea areas, areas of particular environmental interest, and locally managed marine areas as tools to evaluate effectiveness of potential OECMs; includes case study of the Mozambique Locally Managed Marine Area.</td>
</tr>
<tr>
<td>Echeverri et al., 2021b&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Individual site</td>
<td>Discusses potential to use the site-level assessment of governance and equity (SAGE) framework to evaluate the effectiveness of sustained governance within the OECM definition; applied to assess potential OECMs in Colombia</td>
</tr>
<tr>
<td>Donald et al., 2019b&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Multiple sites</td>
<td>Developed 17 criteria to evaluate whether measures currently protecting key biological areas (KBAs) would meet the IUCN definition of OECMs as effective conservation measures; local experts to use the framework to evaluate potential OECMs associated with 740 KBAs across 10 countries</td>
</tr>
<tr>
<td>Gray et al., 2018&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Multiple sites</td>
<td>IUCN and CCEA screening tools used to evaluate 2 potential OECMs in urban areas in Canada</td>
</tr>
<tr>
<td>Marnewick et al., 2021&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Multiple sites</td>
<td>Describes site-level OECM assessment tool with 20 criteria informed by IUCN guidelines and CCEA; provides overview of findings of a national review of potential OECMs in South Africa; describes general findings for 9 sites, 6 of which would likely meet the criteria</td>
</tr>
<tr>
<td>Matallana-Tobón, et al., 2018b&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Multiple sites</td>
<td>IUCN screening tool used to evaluate whether complementary conservation strategies (CCSs) in Colombia could be OECMs based on 3 case studies; suggests many CCSs are likely to qualify, but concludes that where conservation is not the primary objective, effective long-term management may be a barrier for some areas</td>
</tr>
<tr>
<td>Petza et al., 2019&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Multiple sites</td>
<td>Developed expert-based, multicriteria decision tool based on 7 criteria to be used to screen potential OECMs after the IUCN criteria have been applied; framework applied to assess 516 fisheries restricted areas in the Aegean Sea, all were deemed to meet the IUCN criteria but only 21 were considered by experts to be effective at protecting biodiversity</td>
</tr>
<tr>
<td>Shackell et al., 2021b&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Multiple sites</td>
<td>Evaluated effectiveness of recovery of groundfish in fisheries closures that have the potential to be recognized as OECMs under Canadian law; data from long-term study showed that sites had not recovered despite a fishing moratorium since 1993</td>
</tr>
<tr>
<td>Rodríguez-Rodríguez et al., 2021&lt;sup&gt;c&lt;/sup&gt;</td>
<td>System-level assessment</td>
<td>IUCN screening tool used to consider whether a range of potential conservation measures in Spain would qualify as OECMs</td>
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TABLE 2 (Continued)

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<th>Description of study contents</th>
</tr>
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<tbody>
<tr>
<td>Shabtay et al., 2019</td>
<td>System-level assessment</td>
<td>Developed framework to identify potential OECMs that could be integrated into marine spatial planning; applied framework to case studies in Italy and Italy</td>
</tr>
<tr>
<td>Belle et al., 2020</td>
<td>Discussion</td>
<td>Discusses typology to distinguish different forms of area-based conservation; provides examples of existing classifications that could be protected areas or OECMs, such as Indigenous and community conserved areas (ICCAs)</td>
</tr>
<tr>
<td>Egghenter, 2018</td>
<td>Discussion</td>
<td>Describes territories and areas conserved by ICCAs in Indonesia as good candidates for OECMs</td>
</tr>
<tr>
<td>Frascaroli et al., 2019</td>
<td>Discussion</td>
<td>Discusses whether sacred natural sites in Italy have potential to be recognized as OECMs</td>
</tr>
<tr>
<td>Johnson et al., 2019</td>
<td>Discussion</td>
<td>Discusses use of the ecological or biologically significant marine area criteria as a tool to identify potential OECMs in the United Kingdom</td>
</tr>
<tr>
<td>Jonas et al., 2017</td>
<td>Discussion</td>
<td>Argues that some ICCAs could be protected areas and some might be better recognized as OECMs</td>
</tr>
<tr>
<td>Jonas et al., 2018</td>
<td>Discussion</td>
<td>Discusses IUCN screening tool and provides generic examples of potential OECMs across the different IUCN governance types and for sites where conservation is the primary, secondary, or ancillary objective of the area</td>
</tr>
<tr>
<td>Jonas et al., 2021</td>
<td>Discussion</td>
<td>Discusses IUCN screening tool; describes each of the relevant criteria; considers how this voluntary guidance should be applied</td>
</tr>
<tr>
<td>MacKinnon et al., 2015a</td>
<td>Discussion</td>
<td>Discusses development of a screening tool to help Canada identify potential OECMs based on a series of workshops with representatives of federal, provincial, and territorial agencies, Indigenous communities, nongovernmental organizations, and scientists</td>
</tr>
<tr>
<td>Mitchell et al., 2018b</td>
<td>Discussion</td>
<td>Discussed how and when private land conservation could align with protected areas or OECMs; mentions models of private land conservation in Australia and South Africa</td>
</tr>
<tr>
<td>Mwamidi et al., 2018</td>
<td>Discussion</td>
<td>Discusses whether ICCAs that recognize traditional pastoralists management practices in Kenya fit the criteria to be recognized as OECM</td>
</tr>
<tr>
<td>Scheske et al., 2019c</td>
<td>Discussion</td>
<td>Discusses how surfing reserves could be considered protected areas or OECMs, including examples from Peru, Chile, and the United States</td>
</tr>
<tr>
<td>Shwartz et al., 2017</td>
<td>Discussion</td>
<td>Discusses large-scale conservation initiatives (LSCIs) in the United Kingdom, implying they should be considered OECMs</td>
</tr>
<tr>
<td>Wainthaka et al., 2018</td>
<td>Discussion</td>
<td>Describes an assessment used to determine whether wildlife conservancies recognized as OECMs in Kenya met the IUCN criteria</td>
</tr>
</tbody>
</table>

*Appendix S5 contains full list of references.
*Studies with a focus on evaluating effectiveness of sites.
*Studies that include countries that have registered OECMs.

[Matallana-Tobón et al., 2018] (Table 2) to hundreds of similar (e.g., fisheries restricted areas [Petza et al., 2019]) or diverse sites (e.g., key biodiversity areas [Donald et al., 2019]). Two case studies undertook a system-level assessment (Table 2). For example, Rodríguez-Rodríguez et al. (2021) evaluated the spectrum of conservation designations in Spain against the IUCN criteria.

Thirteen studies focused on a more theoretical discussion of potential OECMs. Five of these did not address specific case studies, but rather looked at broad features of OECMs, such as areas outside PAs that benefit biodiversity or general interpretation of the relevant criteria (e.g., Jonas et al., 2018, 2021). The remaining 8 studies considered whether particular types of conservation measures should be considered OECMs (Table 2). These measures were as diverse as Indigenous and community conserved areas (ICCAs) (e.g., Egghenter, 2018; Jonas et al., 2017), sacred natural sites (Frascaroli et al., 2019), and surfing reserves (Scheske et al., 2019).

Five studies attempted to address the question of whether sites provide effective conservation outcomes (Table 2). Three studies used an impact evaluation framework to determine whether biodiversity in existing (2) or potential (1) OECMs had recovered from a fishery closure. The remaining 2 studies asked experts to judge whether they believed sites effectively protected biodiversity (Table 2).

DISCUSSION

The development of OECMs was a step change in conservation, dramatically expanding the concept of area-based conservation. Conservation science has an important role to play in providing a robust interpretation of OECMs and tools to ensure they generate effective, long-term conservation outcomes (Gurney et al., 2021). Greater engagement from the
conservation science and policy community will be vital to guide progress toward the 30x30 commitment in the Global Biodiversity Framework, where OECMs are widely expected to play a significant role (Dudley et al., 2018). Given this imperative, it is timely to synthesize the existing lessons provided by current research on OECMs to identify knowledge gaps and to highlight the research required to ensure countries have the evidence needed to implement OECMs effectively.

It is clear from my results that conservation science was slow to engage with the concept of OECMs. Although it is encouraging to see an increase in the number of studies discussing OECMs, particularly since a formal definition was provided (Figure 1), most studies have not progressed beyond superficial or general references to the concept as part of area-based conservation (Table 1), often limited to a generic statement of the potential for expanding the area under protection (Figure 4a).

The science is still largely focused on PAs, with some authors noting that their findings could potentially also apply to OECMs (e.g., Zafra-Calvillo & Geldmann, 2020). Only a fraction of the literature genuinely engaged with the significance of OECMs for area-based conservation (e.g., Alves-Pinto et al., 2021; Gurney et al., 2021), attempted to advance debate about how OECMs should be defined (e.g., Jonas et al., 2018), or considered their role in meeting national conservation targets (e.g., Lemieux et al., 2019).

Moving beyond discussing risks and benefits

Many studies referred to the perceived benefits and risks associated with OECMs (Figure 4), but very few genuinely engaged with the nature of those issues. More studies mentioned potential benefits than risks associated with OECMs, but it was common for benefits to simply be listed without a discussion of how they would be realized. It was interesting to note that studies highlighting potential risks were more likely to consider both the risks and benefits of the concept (e.g., Alves-Pinto et al., 2021). In many cases, identified risks and benefits were interrelated, and there was optimism that OECMs could increase ecological representation and connectivity (Dudley et al., 2018; Gurney et al., 2021) that was matched by concern that if not carefully implemented, OECMs could undermine conservation outcomes (Dudley et al., 2018; Watson et al., 2016).

Likewise, the potential to unlock additional resources to support the management of sites formally recognized as OECMs (Gurney et al., 2021; Jonas et al., 2017) was balanced by concerns that a lack of additional resources could make it difficult for communities to monitor and manage sites (Jonas et al., 2018) or even lead to resources being redirected from existing PAs (Alves-Pinto et al., 2021). There is evidence that growth in PAs has not been matched by the necessary increase in resources for management (Adams et al., 2019), and rapid growth in OECMs could compound this problem, undermining PAs (Watson et al., 2016). Yet, only 1 study mentioned existing approaches to procuring resources for identification and ongoing management of OECMs (e.g., the Global Environment Fund [Alves-Pinto et al., 2021]). Gurney et al. (2021) suggested novel approaches to funding could be related to the type of OECM, such as watershed management or coastal protection funds. If OECMs are to achieve their potential for conservation, then the lack of consideration of how they can be resourced is a major gap that needs to be addressed.

One of the most commonly reported potential benefits of OECMs was that they may offer formal recognition to areas that are already effectively conserving biodiversity (Figure 4a). However, many of the concerns raised centered around the inability to evaluate whether potential OECMs are effective or to monitor whether those outcomes will be sustained (Figure 4b). There is still no consensus on how to interpret the criterion of “in situ conservation of biodiversity” that the IUCN screening tool defines as conservation of nature as a whole, not just selected elements of biodiversity (IUCN-WCPA, 2019). Even studies that attempted to evaluate potential OECMs did not engage with how conserving nature as a whole could or should be measured. However, this concept was used to argue some existing OECMs do not meet the necessary criteria (e.g., Diz et al., 2018).

A segment of the literature is clearly concerned about the level of protection that will be offered to biodiversity in areas where the primary objective of OECMs is sustainable use and biodiversity conservation is a secondary or ancillary objective (Alves-Pinto et al., 2021; Diz et al., 2018; Lemieux et al., 2019). Studies of PAs show that strict protection often leads to better conservation outcomes (Ferreira et al., 2020) and that some multiuse areas can be less effective at protecting biodiversity (Edgar et al., 2014). Conversely, there is evidence that conservation outcomes can be better outside PAs, such as on Indigenous lands (Alves-Pinto et al., 2022). Conservation science could play a central role in helping to evaluate the effectiveness of different types of OECMs. However, very few studies attempted to move beyond discussing these issues to actually measuring whether OECMs effectively conserve biodiversity relative to surrounding areas (e.g., Beazley et al., 2021; Hiltz et al., 2018). As new OECMs are declared, it may take time to build this evidence base.

Although considering the implications of such a major change to area-based conservation is an important role for conservation science, the claims made about potential benefit and risks associated with OECMs were rarely tested. Furthering the implementation of OECMs will require moving beyond a theoretical discussion to evaluating whether there is evidence that potential risks and benefits occur. For example, because countries are already declaring OECMs, there is an opportunity for researchers to directly evaluate whether these OECMs increase ecological representation and connectivity between existing conservation areas. Studies evaluating whether sites meet the relevant criteria to be OECMs (Table 2) also offer insight into how existing OECMs could be evaluated, addressing the risks (e.g., areas may not benefit biodiversity [Matallana-Tobón et al., 2018] and benefits (e.g., achieving a balance between management objectives [Petz et al., 2019]). More studies are needed that document the benefits associated with currently registered OECMs and to evaluate negative consequences they have for biodiversity (e.g., evaluating conservation outcomes) and local communities (e.g., ethnographic studies). To move the concept
of OECMs forward, a discussion of risks must be paired with recommendations about the types of safeguards that can be adopted to mitigate those risks and promote potential benefits, which is currently lacking.

Advancing understanding about how to recognize OECMs

Despite concerns about the uncertainty associated with identifying suitable OECMs (Figure 4b), only 30 studies addressed how to identify OECMs. With approximately 800 OECMs currently recognized across 9 countries (Protected Planet, 2023), it is perhaps unsurprising that there is not yet a large evidence base describing how existing OECMs were identified or evaluating their performance against the relevant criteria. All of the studies that evaluated or discussed existing OECMs focused on sites in Canada (7) (Table 2), where OECMs are controversial (Lemieux & Gray, 2020). Retrospective studies that document how sites have been screened and registered by countries could help develop models of best practice and resolve some of the difficult questions about the evidence required to
determine whether OECMs meet the relevant criteria (e.g., effective governance [Echeverri et al., 2021]; effective conservation outcomes [Beazley et al., 2021; Petza et al., 2019]). Building this evidence base could help inform the discussions about which areas should count toward protection targets, which preoccupy a considerable section of the OECM literature (Figure 4b).

Although 23 studies discussed potential OECMs, again case studies applying new or existing criteria to screen OECMs were relatively rare (10) (Table 2). Marnewick et al. (2021) describe a process used to review potential OECMs in South Africa. South Africa has since registered OECMs (Protected Planet, 2023), and a follow-up study that provides insight into how existing OECMs were selected and registered could offer valuable lessons for other countries. Several case studies evaluating potential OECMs considered diverse sites, with hundreds of sites across multiple countries (e.g., Donald et al., 2019), whereas some looked across a wide range of potential conservation areas in a single country (e.g., Rodríguez-Rodríguez et al., 2021). These studies provide important insights into the challenges of interpreting general guidance and translating it to specific circumstances. They offer broader lessons for how to interpret OECMs across different contexts, frequently concluding that there is considerable variation in which sites are likely to meet the necessary criteria (e.g., Donald et al., 2019; Marnewick et al., 2021) (Table 2). Although general lessons about which sites should be OECMs are currently elusive, many studies proposed measures that could be good candidates (e.g., ICCAs, sacred natural sites, surfing reserves, and wildlife conservancies) (Table 2), which could form the basis of future case studies.

The inclusion of areas that have experienced habitat degradation as a result of industrial-scale resource extraction has been controversial (Lemieux et al., 2019, 2022). These issues were raised in relation to Canada’s interpretation that OECMs include limited fisheries closures, now called marine refuges (DFO, 2016). The inclusion of these areas, where only some types of fishing gear are restricted, has been heavily criticized (e.g., Diz et al., 2018) (Table 2). Similar questions have been raised about forest management areas in Canada, which allow commercial and industrial activities (Ball & Nixon, 2022). Formally recognizing these areas sets a precedent for failing to comply with existing guidelines, and their recognition could have wider implications for potential OECMs with a history of resource extraction, normalizing OECMs that do not meet the required standard (Lemieux et al., 2022).

### Measuring the effectiveness of OECMs

Studies attempting to evaluate the effectiveness of existing OECMs or to consider whether potential OECMs are currently achieving in situ conservation were extremely rare (Table 2). The majority of these studies used expert judgments to assess conservation outcomes. Although expert judgement is widely used in management effectiveness evaluations of PAs (Cook & Hocking, 2011), the need to demonstrate long-term, in situ conservation of biodiversity is fundamental to OECMs (IUCN-WCPA, 2019). The absence of studies attempting to model how countries could demonstrate OECMs are effective or setting out methods to monitor effectiveness is a significant gap in the current literature.

The few studies that did evaluate the effectiveness of existing OECMs raised questions about whether OECMs should include areas that are set aside for long-term restoration (e.g., Lemieux & Gray, 2020). The IUCN guidelines state that areas under active restoration efforts should not be recognized as OECMs until they are delivering demonstrable and significant biodiversity outcomes (IUCN-WDPA, 2019). Yet, it is unclear what baseline (intact or degraded) in situ conservation of biodiversity should be judged against or at what point an area would be considered sufficiently restored to qualify for OECM status. A single study employed an impact assessment framework to evaluate the condition of biodiversity inside and outside a marine OECM over 12 years (Beazley et al., 2021). There was evidence the benthic community is recovering since declaring the OECM stopped destructive bottom trawling, but also that the ecosystem is still significantly degraded (Beazley et al., 2021). Shackell et al. (2021) also provided long-term data from fisheries closures that demonstrate that exploited species had not recovered. These studies offer a model to judge whether an OECM is better than not having an OECM but do not offer guidance on quantifying in situ conservation of nature as a whole.

### Future research

A look at the current body of knowledge behind OECMs highlights significant gaps in the evidence required to guide the successful implementation of the concept. Filling these gaps will require much more engagement from conservation scientists to address questions about how to identify potential OECMs, to develop tools for transforming the general guidance into more specific recommendations, and to create standards for what is required to demonstrate sites effectively conserve biodiversity. Addressing these important knowledge gaps will require many more studies to build a robust evidence base—particularly, studies that evaluate the effectiveness of potential or existing OECMs. Many existing conservation measures have been suggested as potential OECMs based on existing evidence that they can provide positive biodiversity outcomes (e.g., community managed forests; Hajjar et al., 2021). These studies offer a foundation on which to prioritize research into the types of conservation measures that may make good candidate OECMs, but there is still a need to develop an evidence base that evaluates whether areas meet all the criteria to be recognized as OECMs (IUCN-WCPA, 2019).

There is also a clear need to provide methods to help countries evaluate the effectiveness of existing conservation measures and whether they are potential OECMs. Given that each country must consider how OECMs could apply in their context, studies applying the criteria to screen potential OECMs are critically lacking. A common theme among these studies is that it is not possible to single out particular types of conservation measures as OECMs because it can be highly
variable whether individual sites meet the necessary criteria (e.g., Rodríguez-Rodríguez et al., 2021). This supports the view that OECMs will need to be assessed on a case-by-case basis (IUCN-WDPA, 2019), rather than by recognizing generic conservation measures (Alves-Pinto et al., 2021), which will be resource intensive. Researchers could work with policy makers to develop or adapt tools, such as the Green List Standard (IUCN-WCFA, 2017), SAGE (Echeverri et al., 2021), and ICCA guidelines (Corrigan & Granzier, 2010), to offer resources to support studies evaluating potential OECMs and to ensure national guidance aligns with IUCN guidance (e.g., Lemieux et al., 2019). This nevertheless requires a burden of proof be agreed on to ensure sites meet the necessary criteria.

Before OECMs become a widely used tool, there is a clear need for conservation science to engage with questions about the baseline against which conservation outcomes should be judged. This may involve recognizing a category of candidate OECMs—areas that are on-track to meet the criteria of in situ biodiversity conservation but are still in the process of ecosystem recovery. This approach could also be applied to sites with the potential to improve management, monitoring, and long-term conservation outcomes if given additional support (Matallana-Tobón et al., 2018). Meeting all of the relevant criteria to be recognized as OECMs is challenging for many areas (Rodríguez-Rodríguez et al., 2021); therefore, identifying potential OECMs that could achieve positive outcomes if given additional support could be used to target conservation resources or fund-raising efforts.

Importantly, expanding the number of case studies that evaluate potential OECMs against the necessary criteria will require the development of a realistic framework to assess how conservation outcomes should be defined and determine what is required to demonstrate that these outcomes are being maintained over the long term, including how to monitor and resource sustained governance and management. The case-specific nature of evaluating potential OECMs will require a large number of studies to understand the diversity of contexts associated with OECMs, factors influencing success and failure, and tools that can be used to evaluate different sites. There is a particular lack of interdisciplinary studies that can support the development of OECMs. A single study was identified that attempted to provide a framework with which to judge the effectiveness of governance for potential OECMs (Echeverri et al., 2021) (Table 2). Given the established link between effective management and conservation outcomes for PAs (Geldmann et al., 2018; Gill et al., 2017), this is a major gap in the scholarship around OECMs. Researchers should examine how to evaluate the effectiveness of management and governance structures associated with OECMs, including with sites governed by Indigenous and local communities, private actors, and those with shared governance arrangements (Jonas et al., 2021). Engaging with legal scholars may help identify a range of legal and nonlegislative frameworks that could ensure the longevity of protection for sites with different governance types. However, this would need to include an explicit consideration of the rights of nonstate actors and the tools available to support the development of equitable governance structures (Echeverri et al., 2021).

There are also critical gaps in how to engage Indigenous and local communities or private landholders who may wish to have their contribution to conservation recognized through OECM status (Appendix S3; Jonas et al., 2017; Mitchell et al., 2018). The guidance on recognition of ICCAs (Corrigan & Granzier, 2010) could be an excellent resource for studies exploring factors influencing success and failure in recognizing OECMs under the governance of Indigenous and local communities. This will be critical given the role Indigenous lands are likely to play in supporting poorly protected biodiversity (Garnett et al., 2018). There is also a need for research to identify innovative approaches to resource OECMs and ensure that demonstrating areas meet the necessary requirements to be OECMs does not become a financial burden on local communities (Alves-Pinto et al., 2021) (Appendix S3). This is particularly relevant given that one-off incentive payments, such as those used by some private land conservation schemes, do not offer a sustainable framework to support the management of these in-perpetuity agreements (e.g., Groce & Cook, 2022). Engaging with tools and approaches from economics could help create sustainable mechanisms to support the management and monitoring of OECMs over the long term.

Research needs to meaningfully engage with the types of safeguards required to ensure that OECMs achieve long-term conservation outcomes. At present, conservation scientists have failed to grapple with the difficult question of how to identify effective conservation measures and to develop tools to cost-effectively evaluate and monitor the outcomes associated with these areas across the range of governance types. A failure to resolve key uncertainties around how to recognize, monitor, and report on OECMs could undermine progress toward achieving the 30x30 target. If effort is not invested in the scholarship needed to support the successful implementation of OECMs, the international community will be forced to move forward without the necessary evidence base, increasing the risk that the promised conservation gains will not be realized.

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**SUPPORTING INFORMATION**

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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