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SUPPLEMENT ARTICLE

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Surfing and marine conservation: Exploring surf-break protection as IUCN protected area categories and other effective area-based conservation measures

Christel Scheske[1] | Mara Arroyo Rodriguez[2] | Juan Esteban Buttazzoni[3] | Nik Strong-Cvetich[2] | Stefan Gelcich[4] | Bruno Monteferri[1] | Luis Felipe Rodríguez[3] | Manuel Ruiz[1]

[1] Peruvian Society for Environmental Law (SPDA), Lima, Peru

[2] Save The Waves Coalition, Davenport, California

[3] Fundación Rompientes, Santiago, Chile

[4] Departamento de Ecología, Center of Applied Ecology and Sustainability (CAPES), Center for the Study of Multiple-Drivers on Marine Socio-Ecological, Systems (MUSELS), Pontificia Universidad Católica de Chile, Santiago, Chile

Correspondence
Nik Strong-Cvetich, Save The Waves Coalition, Davenport, CA 95017.
Email: nik@savethewaves.org

Christel Scheske Sociedad Peruana de Derecho Ambiental, Lima, Peru.
Email: cscheske@spda.org.pe

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Abstract

1. The expansion of surfing as a multibillion-dollar industry and sport has, on the one hand, increased awareness about threats posed to marine and coastal environments, but has also brought growing acknowledgement of the environmental, cultural and economic value that surfing provides. This has been accompanied by a growing movement of surfers and related stakeholders (e.g. communities and manufacturers that rely on the surf tourism and industry for income) that seek to protect surf breaks. This paper argues that certain emblematic surf breaks should be protected not only for their value to surfers, but also for the ecosystem services they provide and other benefits for marine conservation.
2. Through a series of case studies from Peru, Chile and the USA, the paper discusses how, in areas where there is significant biodiversity or iconic seascapes, surf breaks can be integrated with marine conservation. Suggestions are given regarding the International Union for Conservation of Nature categories of protected areas that are most appropriate for such cases.
3. The paper also explores how, in certain cases, several existing surf-break protection mechanisms could qualify as other effective area-based conservation measures, including Chile's proposed TURF–surf model, the international World Surfing Reserves, and Peru's *Ley de Rompientes*. In this way, certain surf-break protection mechanisms could help contribute to countries' progress towards achieving the Convention on Biological Diversity's Aichi Target 11.
4. Overall benefits of marine conservation groups and surfers joining forces are discussed, including how this can help reduce negative impacts of the sport on natural ecosystems.

KEYWORDS

Aichi target 11, Ley de Rompientes, marine conservation, marine protected areas, OECMs, surf breaks, surfing, TURFs, World Surfing Reserves

1 | INTRODUCTION

In Polynesia, Hawai'i and what is now Peru, people began riding waves thousands of years ago using simple boards of wood or reed craft (Lazarow, Miller, & Blackwell, 2008). Despite its ancient origins, surfing was suppressed for many years by the colonizers in Hawai'i and was only popularized by Hawaiians in the early 20th century (Lazarow et al., 2008). Since then, the sport has grown continuously, and is now practised across the globe. Indeed, in 2020, surfing will be included as part of the Olympic Games for the first time in history. Surfing contributes billions of dollars to the global economy each year through surf tourism and the surf equipment and apparel industries. Millions of people surf worldwide, with estimates ranging from 18 to 50 million participants globally (Lazarow et al., 2008).

The expansion of surfing as a multibillion-dollar industry and sport has, on the one hand, increased awareness about threats posed to coastal environments, but has also brought growing acknowledgement of the environmental, cultural and economic value that surfing provides. There is an increasing body of literature focused on surfing that has raised understanding of the sport and its relationship with conservation, human wellbeing and economics—see, for example, the bibliography being compiled by the Centre for Surf Research of San Diego State University. Elsewhere, in an extensive literature review of 162 research-based surfing publications, Scarfe, Healy, and Rennie (2009) show that surfing is only a recent topic in coastal literature. This has been coupled by a burgeoning movement of surfers and related stakeholders (e.g. communities and manufacturers that rely on the surf tourism and industry for income) that seek to protect surf breaks. The overlap between environmental conservation and surf-break protection is the focus of this paper.

This paper argues that certain emblematic surf breaks should be protected not only for their value to surfers, but also due to the ecosystem services they provide. Second, it demonstrates how the protection of surf breaks is possible under certain categories of protected areas or other effective area-based conservation measures (OECMs) recognized by the International Union for Conservation of Nature (IUCN), thus contributing to countries' progress towards the Convention on Biological Diversity's Aichi Target 11 (Secretariat of the Convention on Biological Diversity, 2010). The possibilities for integrating surf-break protection with protected areas or OECMs is explored in a series of case studies from around the world, including Peru, Chile and the USA. We encourage governments and the conservation community to recognize the value of surf-break protection as part of the global marine and coastal conservation effort.

2 | THE CONSERVATION VALUE OF SURF BREAKS

A surf break is a rideable wave that breaks in one direction consistently and can be enjoyed by a surfer. As summarized by Reiblich (2013), a surf break has three main components: the sea floor in the area where the wave breaks (which may be a reef, rocks, sandy bottom or other substrate), the swell corridor along which the ground swell travels before reaching the point where the wave breaks, and access for surfers. The effective protection of surf breaks needs to include all of these components, as well as water quality. It should be noted that, although the majority of high-quality surf breaks are natural formations, not all surf breaks are necessarily entirely natural. For instance, several surf breaks along Peru's Costa Verde in Lima are some of the most visited surf breaks in the country and are the result of rocky piers and land reclamation projects in the area.

2.1 | Ecosystem services and surf breaks

Surf breaks are natural resources that provide people with recreation, aesthetic inspiration, cultural identity and spiritual experiences related to the natural environment. Their protection represents an opportunity not only to perpetuate these benefits to human wellbeing, but also to support the integrity of coastal ecosystems. The multiple benefits that nature provides to society and that make human life possible are known as *ecosystem services* (Costanza et al., 1997).

Surf breaks provide many *cultural* ecosystem services. Surf breaks are natural spaces with high recreational value, with benefits to both mental and physical health. With regard to the benefits of spending time in marine environments in general, this is the focus of the UK-based 'Blue Gym' psychology research group, which shows that there are positive effects on both health and happiness for people living close to coasts (White, Pahl, Wheeler, Fleming, & Depledge, 2016). Elsewhere, researchers have investigated the specific effects of surfing, where various studies show the cognitive benefits of surfing on special needs groups (Armitano & Clapham, 2015), and demonstrate the physical health benefits of surfing for children with disabilities. Studies from around the world also show how surfing significantly increases wellbeing and confidence among youth with mental health issues or those suffering from social exclusion (see Gaspar de Matos et al., 2017; Godfrey, Devine-Wright, & Taylor, 2015; Hignett, White, Pahl, Jenkin, & Le Froy, 2018; Stuhl & Porter, 2015).

Many surf breaks are integral parts of iconic seascapes where there is a strong local surfing culture, in places such as Malibu (California, USA), Jeffrey's Bay (South Africa), or the north shore of O'ahu, Hawai'i. Usually, these emblematic surf breaks are considered 'world class'; that is, they are of exceptional quality and provide an excellent surfing experience in comparison with most other surf breaks. Such surf breaks have inspired many forms of art, from fashion (e.g. brands such as Quiksilver) to indigenous tattoo art in the Polynesian islands. In a survey of over 1000 California surfers, Reineman and Ardoin (2018) found that the majority had a significant place attachment to their surf spots.

Furthermore, emblematic surf breaks have high economic value, with new research on 'surfonomics' demonstrating this in monetary terms. Lazarow et al. (2008), in a review of multiple studies that estimate the contribution of surfing to different economies, indicate that the numbers vary greatly, anywhere from several hundred thousand US dollars to hundreds of millions US dollars, depending on the locale and the study methods. Other examples of surfonomics include

Lazarow's (2009) estimate that the Australian Gold Coast generates around US$180 million per year due to surfers' expenditures. Scorse, Reynolds, and Sackett (2015) estimate that a home near a surf break in Santa Cruz, California, is valued about US$106,000 more than a similar home further away from the surf break.

2.2 | Surfers as environmental activists

There is emerging evidence in social psychology that surfing raises environmental awareness among surfers, some of whom are therefore more inclined to protect the environment and support conservation causes. For instance, Brymer, Downey, and Gray (2009) show how many extreme sports athletes, including surfers, care for nature due to their nature-based sport, and Hignett et al. (2018) show that at-risk youth achieved higher environmental awareness after engaging in surfing. A survey conducted by the non-governmental organization (NGO) Sustainable Surf and the University of Plymouth shows that, of 500 respondents, 84% indicated that surfing raises their environmental awareness, due to both their greater level of connection with nature and their direct confrontation with negative human impacts on the ocean, such as pollution (Sustainable Surf, 2018). White et al.'s (2016) Blue Gym group mentions a number of studies that show a link between time spent in marine environments and higher propensity for environmental activism, with this being a primary focus for future research by the group.

The connection between conservation and surfing may be due to surfers' frequent and long interactions with the marine environment, and, importantly, because negative environmental effects also tend to be detrimental for surfing; for example, plastic pollution, sewage, and industrial construction that threatens a surf break. Notably, there are several conservation organizations around the world that were founded by surfers (Table 1), most of which focus on both the protection of surf breaks and the conservation of marine ecosystems. Though the aforementioned research by no means implies that all surfers are environmental activists by default, it does seem to show that a significant number of surfers will engage in environmental action due to their relationship with surf breaks and their self-interest in protecting their activity. The challenge for the conservation community is to leverage this potential pool of human and capital resources for marine conservation.

2.3 | Biodiversity and seascape value

More site-based research is needed to understand the potential biodiversity value of specific intact surf breaks, while accounting for the

TABLE 1 Examples of campaigns, organizations and initiatives for the protection of surf breaks and their surrounding marine-coastal environments

Organization/initiative	Active years	Objective
Surfrider Foundation (international)	1984–present	Protects marine and ocean environments, including surf breaks. https://www.surfrider.org/
Surfers Against Sewage (UK)	1990–present	Campaigns against destruction and threats to coastal-marine ecosystems and surf breaks through infrastructure development, sewage disposal, etc. https://www.sas.org.uk/
Association for the Conservation of Peruvian Waves and Beaches (Peru)	1992–2001	Protected emblematic waves in Peru. It played a key role in pushing for legislation to protect waves in Peru, passed in 2001.
Surfers for Cetaceans (international)	2004–present	Campaigns for the protection of cetaceans worldwide. https://www.s4cglobal.org/
Save the Waves Coalition: World Surfing Reserves Program (international)	2009–present	Creates a network of protected surf breaks around the world through the World Surfing Reserves mechanism. https://www.savethewaves.org/
Surfbreak Protection Society (New Zealand)	2012–present	Conservation of the emblematic surf breaks of New Zealand through the preservation of their natural characteristics, water quality, marine ecosystems and public low-impact access. http://www.surfbreak.org.nz/
HAZla por tu Ola (Act for your Wave) (Peru)	2015–present	Citizen-led campaign for the protection of surf breaks in Peru and their inclusion in the national register of protected breaks. http://hazlaportuola.pe/
Fundación Punta de Lobos (Chile)	2016–present	Protects the terrestrial area surrounding Punta de Lobos surf break in Pichilemu. http://puntadelobos.org/en/
Fundación Rompientes (Chile)	2017–present	Seeks legal protection of surf breaks in Chile. Combines marine conservation with community-based approaches. http://www.rompientes.org
Surf & Nature Alliance (international)	2017–present	Campaigns for the protection of surf breaks as well as sustainable coastal development. https://surfnaturealliance.org/

diverse types of surf breaks that exist (e.g. sandy bottom, reef breaks). Natural surf breaks require the continued intactness of the bathymetric conditions that generate the break. Alterations to these conditions, for instance through dredging or pier construction, would usually adversely impact the surf break. Since the associated biodiversity (particularly benthic) also depends on the intact bathymetry or nearshore conditions, the protection of surf breaks could also have benefits for local biodiversity in tropical, subtropical, temperate and even polar systems.

Coastal biodiversity associated with surf breaks can include sandy bottom, coral reef, rocky reef and kelp forest ecosystems. These systems are key to sustaining communities of reef-fish, benthic resources and infauna. For instance, rocky reef ecosystems in the surf break of Roca Cuadrada in Chile sustain a kelp forest ecosystem (*Macrocystis*) with more than 32 species of sessile macroinvertebrates, 19 mobile invertebrates and 20 species of reef fish (Ilustre Municipalidad de Navidad, 2008). Species include the red sea urchin, whose habitat is mainly associated with rocky reef breaks, and *Graus nigra*, a reef-fish endemic to the southern Humboldt Current ecosystem and described as threatened by overfishing (Godoy, Gelcich, Vasquez, & Castilla, 2010).

An important discussion is the value of surf breaks as part of larger land- and sea-scapes. For instance, the Illescas Peninsula in northern Peru is currently a Reserved Zone, which is a temporary designation before a protected area category is agreed upon. The area includes spectacular coastal desert landscapes, sand dunes and pristine beaches. It is home to South American sea lion colonies (*Otaria flavescens*) and is one of the few places along the Peruvian coast where the Andean condor (*Vultur gryphus*) is regularly seen, a species considered Near Threatened by the IUCN Red List (BirdLife International, 2017), and Endangered within Peru (MINAGRI, 2014). Punta Malnombre is a world class surf break that forms part of this land- and sea-scape and is one of the principal reasons why tourists visit the area.

In Chile, Punta de Lobos is one of the most important surf breaks for big-wave surfing globally. It is part of a stunning coastal landscape with sheer cliffs, pillar rock formations in the sea, and sandy beaches. Noteworthy terrestrial biodiversity here includes the cactus *Echinopsis bolligeriana*, considered Endangered on the IUCN Red List (Walter, Faundez, & Guerrero, 2013). The surf break is the area's main attraction.

Conservation International and Save the Waves, having launched a new partnership in 2018, have published a map (Figure 1) showing overlap between biodiversity hotspots (as defined by the Critical Ecosystems Partnership Fund) and a list of top iconic surf breaks around the world. Although this analysis is at a very large scale, it provides a baseline for understanding opportunities for integrating conservation with surf-break protection.

Not all surf breaks, however, have significant value in terms of biodiversity or land- and sea-scapes. The overlap between a surf break and biodiversity or seascape of high conservation value must be evaluated to assess the compatibility of conservation with surf break protection measures.

3 | THREATS TO SURF BREAKS AND THE SURFING COMMUNITY'S RESPONSE

Around the world, both surf breaks and coastal-marine ecosystems are threatened by a variety of factors related to climate change,

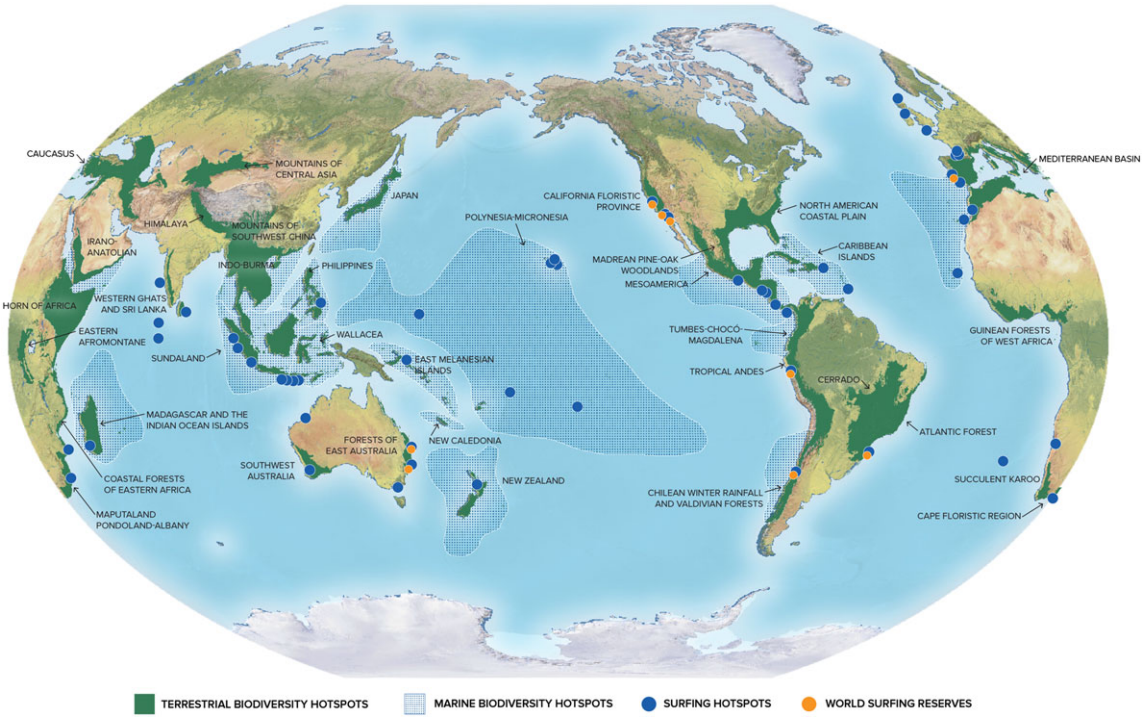


FIGURE 1 Map showing overlap between biodiversity hotspots, iconic global surf breaks, and World Surfing Reserves

such as rising sea levels, ocean acidification and ocean warming (Espejo, Losada, & Mendez, 2014; Harley et al., 2006; Hoegh-Guldberg & Bruno, 2010; Reineman, Thomas, & Caldwell, 2017). Simultaneously, there are multiple other anthropogenic threats, including coastal development, marine pollution, oil spills, coastal erosion and restrictions to public beach access (Corne, 2009).

Surf breaks easily lose their quality or cease to exist altogether if key conditions are altered, such as the swell corridor (e.g. interrupted by a wave breaker), sedimentation (e.g. due to the construction of a pier that changes the movement of sand with the currents), water quality (e.g. oil spills, or sewage that is pumped directly into the sea) or limitations to public beach access (e.g. due to private beach condominiums). Some emblematic surf breaks have already been destroyed or are currently threatened by human activity (Table 2).

Importantly, threats to surf breaks not only threaten the surfing sport, but also the various ecosystem services and related benefits discussed earlier. The development threats posed to surf breaks have evoked various responses by the surfing community to protect their favourite surfing spots, and several NGOs exist that work in this field. The Surfrider Foundation has run campaigns for over 30 years to protect both surf breaks and the wider marine environment through a network of thousands of activists. The Save the Waves Coalition protects surf breaks and coastal ecosystems globally and implements initiatives such as World Surfing Reserves and campaigns to protect emblematic locations under threat. Surfers Against Sewage focuses in particular on plastic and other pollution threats to surf breaks and coastlines. Whereas these actors operate internationally, there are many more instances of national and local-level initiatives, such as HAZla por tu Ola (Act for your Wave) in Peru or Fundación Punta de Lobos and Fundación Rompientes in Chile (see Table 1).

Currently, in most countries, management of surf breaks is not practised at the government level, and even in places with rich cultural surfing histories, like California, surfers have only recently started to have a political say in the management of their recreational space (Scarfe et al., 2009).

The mechanisms used to protect surf breaks vary widely. New Zealand, for instance, is one of the few countries where the government actively protects surf breaks by explicitly including them in its coastal and marine planning process (Peryman, 2011; Peryman & Skellern, 2011). Elsewhere, Peru has created a registry through which specific waves are protected by the navy. On an international level, the Save The Waves Coalition has created a mechanism called the World Surfing Reserves, through which communities commit to protecting their iconic surf breaks. World Surfing Reserves are not legally binding, but they may be coupled with local legal mechanisms for surf-break protection, where these exist. To help inform such efforts, Martin and Assenov (2014) developed a Surf Resource Sustainability Index that provides a wide set of criteria for assessing a surf break's appropriateness for protection, based on social, economic, environmental and governance criteria.

TABLE 2 Examples of high-quality surf breaks threatened, altered or destroyed by human activities

Surf break name	Location	Threat by category
Playa Encuentro	Dominican Republic	*Public access*. Hideaway Beach Resort closed public access to the break as part of its infrastructure expansion project.
Killer Dana	California	*Access and infrastructure*. The Army Corp of Engineers closed the beach to all marine activities to build a recreational harbour.
Male Point	Maldives	*Infrastructure*. Tetrapods were placed around the island for coastal protection, thus destroying the surf break.
Molle	Sweden	*Infrastructure*. Building of a breakwater to protect harbour boats destroyed the surf break.
Jardim do Mar	Madeira	*Infrastructure*. Construction of a promenade changed the wave dynamics, greatly reducing the 'surfability' of the wave.
Mundaka	Spain	*Dredging*. Over 300,000 m^3 of sand were dredged from the sea floor, thus affecting the shape of one of the world's highest quality waves.
Bastion Point	Australia	*Infrastructure:* A boat ramp and jetty were constructed, thus destroying the wave.
Cabo Blanco	Peru	*Infrastructure*. A fishing pier essentially cut the surf break in half, while a new pier is currently under construction that could further impact the wave.
La Herradura	Peru	*Infrastructure*. An unsuccessful road project destroyed the natural hill surrounding the bay, changing the ocean floor and thus affecting the surf break.
Topocalma	Chile	*Public access*. A private owner closed public access to the break due to a real-estate project developed in the adjacent beach of Puertecillo.

4 | SURF-BREAK PROTECTION THROUGH THE IUCN PROTECTED AREA FRAMEWORK OR OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES

Emblematic surf breaks have significant conservation value owing to their provision of cultural ecosystem services, their importance for human wellbeing, their role in creating spaces that foster environmental activism and, in certain cases, owing to their importance for biodiversity and the integrity of land and seascapes. At the same time, many are acutely threatened by various forms of human activity. Encouragingly, there is an active community of people who are both able and willing to implement innovative mechanisms for surf-break protection, while also considering wider marine conservation targets.

Surf breaks, it is argued, should and can be considered under certain frameworks for area-based protection as defined by the IUCN. Their protection could contribute to countries achieving Aichi Target 11, which is:

> *By 2020, at least 17 percent of terrestrial and inland water areas and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape (Secretariat of the Convention on Biological Diversity, 2010).*

4.1 | Surf breaks and protected areas

The IUCN defines a protected area as:

> *A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley, 2008).*

To our knowledge, no marine protected area has been created to date with the principal purpose of protecting a surf break.

However, there are examples of surf breaks that are located within protected areas that were created for other conservation reasons. For instance, surf breaks along the Santa Cruz, Cayucos and Montana de Oro coastlines in the USA have benefited from the existence of the Monterey Bay National Marine Sanctuary, the Point Buchon Marine Reserve and the White Rocks Conservation Area in California, and the limitations they have placed on further development of nuclear and energy infrastructure. The Gnaraloo, Dunes and Red Bluff surf breaks are part of the Ningaloo Marine Park in Western Australia, with strict rules regarding visitor carrying capacity. Roca Bruja in Costa Rica is part of the Santa Rosa National Park and also has rules regarding the number of visitors/surfers. The big-wave surf break of Killers at Todos Santos Islands is part of the Biosphere Reserve of the Islands of the Pacific Ocean, and the draft management plan specifically includes surfing. However, so far, there has not been a comprehensive study that analyses how many surf breaks exist within the boundaries of protected areas and how access to those surf breaks is regulated.

The IUCN considers six main categories of protected areas, which are summarized in Table 3. We argue that there are four categories that are particularly appropriate for the protection of surf breaks: Category III for cases where the surf break is the primary focus of protection, and Categories II, V and VI when the surf break is part of a wider set of marine and coastal features considered important. Since protection of surf breaks implies access and use of the site by surfers and related stakeholders, surf break protection is

TABLE 3 IUCN categories of protected areas, highlighting those considered by us as most appropriate for surf break protection (Dudley, 2008)

Category no.	Description
Ia	**Ia Strict Nature Reserve:** Category Ia areas are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.
Ib	**Ib Wilderness Area:** Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
II	**II National Park:** Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
III	**III Natural Monument or Feature:** Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.
IV	**IV Habitat/Species Management Area:** Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.
V	**V Protected Landscape/Seascape:** A protected area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
VI	**VI Protected area with sustainable use of natural resources:** Category VI protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level nonindustrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

particularly appropriate to those IUCN categories and zoning areas that allow recreational activities. Indeed, surf breaks' strong visitor attraction factor creates an excellent opportunity to use sustainable tourism approaches and interaction with nature to generate funds for protected areas.

4.1.1 | Surf breaks and Category II National Park

The 'National Park' category is appropriate for protecting surf breaks that are part of a larger natural area set aside to maintain ecological integrity at the ecosystem scale. Objectives of national parks include promoting education, recreation and contributions to local economies through sustainable tourism (Dudley, 2008). Surfing can be a recreational and educational experience promoted in National Parks, if regulations and zoning measures are in place to minimize and mitigate impacts of surfing visitors to the protected ecosystems.

For instance, G-Land in East Java, Indonesia, is part of the Alas Purwo National Park. G-Land is one of the most iconic waves in Indonesia. Only three surf camps have been allowed in the area, with a specific limit on the number of surfers permitted entry.

4.1.2 | Surf breaks and Category III protected areas: Natural Monument or Feature

The 'Natural Monument' category is appropriate for protecting emblematic surf breaks where these are not part of a larger land- or seascape that needs protecting. The surf break itself and the immediate surrounding features, such as rock formations, are the conservation targets. In addition to the definition shown in Table 4, the IUCN further stipulates that Natural Monuments are:

> *perhaps the most heavily influenced of all the categories by human perceptions of what is of value in a landscape or seascape rather than by any more quantitative assessments of value […] Management is usually focused on protecting and maintaining particular natural features (Dudley, 2008).*

In this case, the value of the surf break is based on the value that surfers attribute to it, as well as the related stakeholders that rely on the surfers (e.g. tourism operators, restaurants, surf schools). Meanwhile, management focuses on preventing the bathymetric, water quality and similar changes that could affect the quality and functioning of the surf break.

For instance, the Lobitos surf break in northern Peru is considered one of the most 'perfect' waves the country has to offer. It was included in a list of potential terrestrial and marine pilot sites for creating the first natural monuments in Peru (Sociedad Peruana de Derecho Ambiental, 2016). Lobitos is highly visited by both national and international surfers, providing a source of income for local businesses such as hotels, restaurants, and surf schools. Designation of the surf break and the surrounding beaches as a natural monument would not only help increase visibility of the area, but also help ensure management measures and sustainable use rules, such as regulating infrastructure development and waste management.

TABLE 4 Main elements for defining other effective area-based conservation measures as recognized by the IUCN (IUCN-WCPA, 2018)

Criterion	Description
A geographically defined space	Spatially defined with agreed and demarcated boundaries, which can include land, inland waters, marine and coastal areas or any combination of these.
Not protected areas	Areas that are already designated as protected areas or lie within protected areas should not also be recognized or reported as other effective area-based conservation measures (OECMs).
Governed	The area is under the authority of a specified entity, or an agreed-upon combination of entities, including: (i) governments, (ii) shared governance (various rights-holders), (iii) private individuals, organizations or companies, and (iv) indigenous peoples and/or local communities.
Managed	The area is being managed in a way that leads to positive biodiversity conservation outcomes.
Long term	The governance and management of OECMs is expected to be long term in intent. Short-term or temporary management strategies do not constitute an OECM.
Effective	OECMs should be effective in delivering the in-situ conservation of biodiversity.
In-situ conservation	OECMs are expected to achieve the conservation of nature as a whole, rather than only selected elements of biodiversity.
Biodiversity	OECMs must achieve the effective and sustained *in-situ* conservation of biodiversity.
Ecosystem services	Protection of these ecosystem services will be a frequent driver in the recognition of OECMs.
Cultural and spiritual values	OECMs include areas where the protection of key species and habitats and management of biodiversity may be achieved as part of long-standing and traditional cultural and spiritual values.

4.1.3 | Surf breaks and Category V protected areas: Protected Landscape/Seascape

Category V is appropriate for the protection of surf breaks that are part of a wider marine and coastal landscape/seascape that is worth protecting mainly for its scenic value, and the sustainable interaction between humans and nature in the area. In this case, the surf break does not need to be the primary focus for the creation of the protected area; however, it should be explicitly mentioned, so that it can be included in management measures. This allows, for instance, for controlled surf tourism to provide income to the protected area.

The Monterey Bay National Marine Sanctuary in California is considered a Category V protected area (Protected Planet, 2018),

encompassing over 1.5 × 10^6 ha of marine and coastal habitats while considering a multitude of human uses. Two of the most prominent surf breaks in the Sanctuary are Mavericks, an iconic big-wave surf break, and Steamer Lane in Santa Cruz. The management plan for the Sanctuary explicitly deals with surf; for instance, by regulating the use of motorized personal watercraft that are used particularly for big-wave surfing, in order to minimize impacts on wildlife (National Marine Sanctuary, 2008).

4.1.4 | Surf breaks and Category VI protected areas: Protected area with sustainable use of natural resources

Category VI focuses on large areas that combine conservation with sustainable use of the natural resources. As is the case for Category V, surf breaks are part of a broader set of conservation objectives. Surfing and surf tourism are part of a series of sustainable use types in the area, such as locally managed fishing regimes.

A successful example of this is the 217,594 ha Paracas National Reserve in Peru, a Category VI marine protected area established in 1975. The reserve includes a highly-valued surf break at the island of San Gallan, accessible only via boat. For most of the reserve's history, the surf break was part of a strict protection zone; hence, surfing was officially prohibited (Instituto Nacional de Recursos Naturales [INRENA], 2002). However, surfers continued to visit the spot and even organized annual surf competitions (W. Wust, personal communication, November 2018). Around 2015, a dialogue was initiated between surfers and the reserve management committee to legalize and regulate surfing at San Gallan, and to value surfing for its potential income for the reserve, while ensuring that impact to wildlife be kept to a minimum (INRENA, 2002). The process was a success: in 2016, the new management plan of the reserve changed the zoning regulations around the surf break to allow for sustainable use (Servicio Nacional de Áreas Naturales Protegidas [SERNANP], 2016). Another significant step is that the surf break is now explicitly mentioned as an asset of the reserve, and access to the surf break is regulated via licensed tour operators (SERNANP, 2016).

4.2 | Surf-break protection mechanisms as OECMs

The topic so far has shown why decision-makers should consider surf breaks as part of marine and coastal protected areas planning, and how this could integrate with current IUCN protected area categories. Meanwhile, the following discussion focuses on how existing, innovative surf-break protection measures from around the world can be integrated with marine conservation and thereby help achieve international conservation targets.

The Convention on Biological Diversity allows for several conservation management measures to count towards the Aichi Target 11, beyond the traditional national protected areas; these measures are called OECMs. Having been introduced only recently, the draft guidelines on OECMs define them as follows:

> *A geographically defined space, not recognized as a protected area, which is governed and managed over the long-term in ways that deliver the effective in-situ conservation of biodiversity, with associated ecosystem services and cultural and spiritual values (IUCN-WCPA, 2018).*

The IUCN differentiates between OECMs and protected areas as follows: 'while protected areas should have a ***primary*** conservation objective […], the defining criterion of an OECM is that it should ***deliver*** the effective and enduring *in-situ* conservation of biodiversity, ***regardless*** of its primary management objectives' (IUCN WCPA, 2018).

The main elements of an OECM are listed in Table 4.

Where an at-risk, iconic surf break is not located within a protected area that protects it de facto, other forms of protection are necessary. Some of the diverse actors mentioned in Table 1 have developed different mechanisms to protect surf breaks around the world. Some surf break protection mechanisms use legislative approaches, whereas others focus on community-based, voluntary protection. The following case studies illustrate some of the most successful examples of surf break protection. Importantly, some of these cases of protected surf breaks could qualify as OECMs, and thereby contribute to countries achieving Aichi Target 11. So far, none have been officially recognized as OECM.

4.2.1 | Case study 1: The World Surfing Reserves

The World Surfing Reserves (WSR) programme was created by Save The Waves Coalition and partners in 2009. The WSR programme is a global network of informally conserved areas that protect unique surfing locations and their coastal environments and builds capacity with local partners for long-term conservation of each WSR. Save The Waves guides the community through a stewardship planning process that identifies critical threats to the WSR, root causes, strategies and concrete actions to protect the WSR, including avenues toward legal protection. The network currently includes 10 WSR sites worldwide (shown in Figure 1): Malibu (California), Ericeira (Portugal), Manly Beach (Australia), Santa Cruz (California), Huanchaco (Peru), Bahia de Todos Santos (Mexico), Punta de Lobos (Chile), Gold Coast (Australia), Guarda Do Embaú (Brazil) and Noosa (Australia).

WSR-eligible waves and surf zones are evaluated by a panel of independent international experts called the Vision Council, and chosen based on the criteria in Table 5. Importantly, a key criterion for WSR qualification is whether or not a surf break is also located in an area of biodiversity significance, demonstrated by the presence of endangered species, or recognition as a biodiversity hotspot (see environmental criteria in Table 5).

Once a WSR site has been approved, a local stewardship council is formed and begins a stewardship planning process based on the Open Standards for the Practice of Conservation of the Conservation Measures Partnership. The local stewardship council identifies coordinates for the WSR site and outlines the vision and goals for the site, articulates threats and underlying factors, develops strategies for

TABLE 5 Selection criteria for World Surfing Reserves (Save the Waves)

Quality and consistency of the wave(s)	Environmental characteristics		Culture and surf history	Capacity and local support
1. Quality of wave(s) (defined by Surfline.com ranking)	1. Recognized biodiversity hotspot (as defined by CEPF or WWF)	6. Undeveloped area (based on satellite imagery)	1. Site of national cultural significance (as defined by applicant)	1. Support from surf community, government, civil society, private sector, academia (letters of support)
2. Surfable days/year (defined by wannasurf.com estimate)	2. Threatened species present (listed on IUCN Red List)	7. Key issue/threat identified (stewardship issue to be mitigated by the WSR)	2. Importance in surf history (as defined by applicant)	2. Sustainable financing (as defined by applicant)
3. Site of pro contest (defined by WSL, or ISA presence)	3. Connected to water resources (defined by Blue Line status or Ramsar site)	8. Clear avenue for legal protection locally (pre-existing legal regime or political feasibility for new regime)	3. Site of regional significance (as defined by applicant)	3. Clearly identified manager (as defined by applicant)
4. Wave variety (defined by diversity of surfing levels)	4. Past/present wave threat likely to be mitigated (defined by applicant)	9. Provides key ecosystem services (WSR has additional ecosystem benefits beyond surf protection)		4. Surf is key part of local economy (as defined by applicant)
	5. Protected area designation (local, regional, state or national protected area designation)			5. Clearly identified WSR ambassador (as defined by applicant)

CEPF: Critical Ecosystem Partnership Fund; ISA: International Surfing Association; IUCN: International Union for Conservation of Nature; WSL: World Surf League;WSR: World Surfing Reserves; WWF: World Wide Fund for Nature.

reducing or eliminating the threats, and outlines actions to be undertaken by the community partners.

Options for legal protection of the site are articulated within the stewardship plan. The WSR mechanism is international in nature and is based on voluntary commitments by local stakeholders to protect the site. Where possible, local stewardship councils pursue locally available options for legal protection of the WSR. In some cases, this may imply pushing for the creation of a protected area around the site, whilst elsewhere, legal mechanisms may be available to protect the surf break, as is the case in Peru (discussed in more detail in the Section 4.2.2). In other cases, further legal protection may not be necessary, as is the case for the Santa Cruz WSR, which is located within the previously created Monterey Bay National Marine Sanctuary.

It is our view that there are cases where the WSR site could be recognized as an OECM; namely when (a) the WSR coincides with an area of high biodiversity significance, which is recognized by the host government, (b) the site is under some form of legal protection that is also effective for biodiversity conservation, and (c) the site is not part of a protected area. How the WSR mechanism in general applies to OECM criteria is illustrated in Table 6.

The compatibility of OECM criteria with WSRs is demonstrated in three examples of WSRs from Peru, Chile and Mexico.

- *Huanchaco WSR, Peru:* Huanchaco, located on the northern Peruvian coast, is widely known for a rich history in surfing. Archaeological evidence suggests that local fishers used their *caballito de totora* reed fishing vessels as one of the world's first surf-craft some 2,500 years ago, a technique that is still used on a daily basis by Huanchaco's fishers. Huanchaco is an example of a seascape with a long history of human interaction that depends on the intactness of the ecosystem, for both fishing and tourism. The Huanchaco WSR Local Stewardship Council, working with Save The Waves and the HAZla por tu Ola campaign, was one of the first sites in Peru that secured legal and permanent protection under Peru's *Ley de Rompientes* (law for the protection of surf breaks—described in more detail in Section 4.2.2). When put to the test, the WSR helped to permanently halt plans for several jetties proposed for the town's main beach, which would have endangered the surf break and impacted the traditional fishing practice. However, so far, there is only little information about the biodiversity significance of the site, and how the WSR is benefiting it. Until more information is available to demonstrate that the WSR protects not only the surf break but also significant biodiversity, the Huanchaco WSR could not yet qualify as an OECM.
- *Bahía de Todos Santos WSR (BTSWSR), Mexico:* The BTSWSR is located at the north end of the city of Ensenada, on the Pacific side of the Baja California peninsula in Mexico. In this region, there has been an important local planning process to protect the region's natural resources, a combined effort of the community, environmental and government actors, described by Arroyo, Levine, and Espejel (2019). For example, the need to protect Ensenada's remaining

TABLE 6 OECM criteria applied to the World Surfing Reserves surf-break protection mechanism

OECM criteria	Does the WSR programme meet the criteria?	Comments
Geographically defined space	Yes	Each WSR has geographic coordinates associated with a boundary created by the local stewardship council.
Not a protected area	Yes	Considered would be only those WSRs not already located within a protected area.
Governed	Yes	WSRs have a local stewardship council that includes stakeholders from the surfing community, local government, the non-governmental organization community, the business community and academia in a shared governance model (i.e. governance by various rights-holders and stakeholders together). In some cases, governance is led by private individuals, organizations or companies, in line with the WSR's stewardship plan.
Managed	Yes	Each WSR is required to create a WSR stewardship plan, which is based on the Conservation Measures Partnership framework. The plan outlines reserve objectives, threats, root causes, strategies and specific actions to be taken to manage the area's resources. The development of this plan implies collaboration and consensus within the local stewardship council and key partners. Where the management measures for the surf break is based also on legal protection, they may provide de facto protection for some forms of biodiversity.
Long term	Yes	The WSR recognition is indefinite, unless the WSR is not meeting minimal criteria for stewardship.
Effective	Yes	Because of the top-down and bottom-up combination of management for the areas, the WSRs have been very effective in addressing threats to the surf break, usually in the form of urban development such as jetty construction, which would also have damaged benthic ecosystems. In Punta de Lobos, a development threat of a hotel and underground parking structure was eliminated by the WSR process. In Huanchacho Peru, the WSR halted the planned construction of jetties that would have jeopardized the local artisan fishing culture and benthic biodiversity.
In-situ conservation	Yes	The WSR protects a specific coastal area, the cultural ecosystem services and certain aspects of the biodiversity that depends on the area.
Biodiversity	Partially	WSRs are not exclusively focused on biodiversity, but may provide ancillary protection depending on the specific use restrictions that apply. WSRs usually protect those aspects of biodiversity that would be affected mainly by infrastructure development, such as sedimentation processes, benthic habitats, bird nesting sites and marine mammal colonies. It should be noted that WSRs do not usually restrict fishing activity and can therefore be considered akin to protected areas with an emphasis on human use.
Ecosystem services	Yes	WSRs protect cultural ecosystem services provided by the surf break, such as cultural identity, human well-being, recreation and tourism.
Cultural and spiritual values	Yes	Surf breaks have cultural value not only to local communities near the break, but also the global surfing community. One of the criteria for the selection of a WSR is the surf break's relation to local history and culture. Examples like Peru's Huanchaco illustrate this point, where the WSR helps protect a traditional fishing and surfing culture thousands of years old.

OECM: other effective area-based conservation measure; WSR: World Surfing Reserve.

natural coastal environments, together with the desire to have recreational areas for the local community, has encouraged diverse NGOs to promote the creation of protected areas in the region. One of the key initiatives of the BTSWSR, together with the Mexican NGO Pronatura Noroeste, was the creation of the first state park in Baja California at the San Miguel watershed. Today, the BTSWSR is working with Pronatura Noroeste and the Secretariat of Environmental Protection to finalize this process. The designation of San Miguel stemmed directly from the efforts of the local community to preserve public open space for future generations and the need to protect Ensenada's remaining natural coastal environments and the biodiversity of the watershed (Arroyo et al., 2019).

Although the actual surf break is not inside the designated area for the state park, this watershed is a critical riparian ecosystem that contributes necessary sand and cobblestones to form the iconic wave of San Miguel (Arroyo et al., 2019). BTSWSR is now exploring

mechanisms to extend the protection to the marine area and include the surf break. Should this not happen, the BTSWSR could qualify as an OECM.

- *Punta de Lobos WSR, Chile:* Chile's Punta de Lobos was mentioned earlier for its significance for both surfing, seascape and biodiversity. After becoming the seventh WSR, the local stewardship council sought to protect Punta de Lobos from the possibility of large-scale development projects by working with government officials and business leaders in Pichilemu, given that the zoning regulations would have allowed for new private developments. A local foundation (Fundación Punta de Lobos) was created to purchase key coastal properties and manage them under conservation easements (*servidumbres voluntarias*). Now, beyond protecting the surf break, Fundación Punta de Lobos also helps steward the land and works to safeguard biodiversity. Chile has not recognized the area as a private protected area, hence the scheme could qualify as an OECM for its protection of local biodiversity and the seascape.

These examples demonstrate the flexibility of the WSR approach to conserving surf resources, while providing ancillary conservation benefits for biodiversity and seascape protection. In those cases where WSRs legally protect surf breaks with demonstrably high biodiversity and seascape value, and there is no protected area, countries could consider recognizing the WSR as an OECM.

4.2.2 | Case study 2: The Peruvian *Ley de Rompientes*

In Peru, significant threats to the iconic surf breaks La Herradura and Cabo Blanco in the early 1990s encouraged a group of surfers to create the Association for the Conservation of Beaches and Waves, who, in cooperation with the National Surfing Federation and the Peruvian navy, led the effort for the creation of the world's first legal framework specifically created to protect surf breaks, through the *Ley de Preservación de las Rompientes apropriadas para la Práctica Deportiva*, or in short *Ley de Rompientes* (law for the protection of surf breaks), approved in 2000. It took another 13 years of negotiations to finalize the accompanying regulations to the law, making it possible to apply the framework to protect surf breaks.

Notably, the law is not part of the protected area legal framework, managed by the Ministry for Environment; rather, it falls under the responsibility of the navy, part of the Ministry of Defence, which manages the allocation of use rights over aquatic areas. The law defines surf breaks as being part of Peru's natural heritage and establishes that all surf breaks in Peru are state property. This means the public is entitled to access and enjoy all surf breaks. In order to protect a surf break, the National Surfing Federation must file a request to the navy, which includes technical (bathymetric) studies that justify the existence of the surf break. If the request is approved, the surf break is included in the National Register of Protected Surf Breaks.

A protected surf break implies that: '… no rights over the area or aquatic usage will be granted, nor for the development of infrastructure, or other rights which may affect or overlap with the area of the surf break and its surrounding areas' (Congress of the Republic, 2013, Title IV, Art. 10). The law prohibits '… any action or activity which is foreign to the acts of nature, which deform, diminish and/or eliminate the normal or ordinary travel path of the wave appropriate for surfing, the sea bottom, or alters the normal course of currents or tides' (Congress of the Republic, 2013, Chapter II, Art. 12). The only exception to this is if a planned project is declared of national interest (a complex procedure in itself), although this would still require a prior environmental impact study.

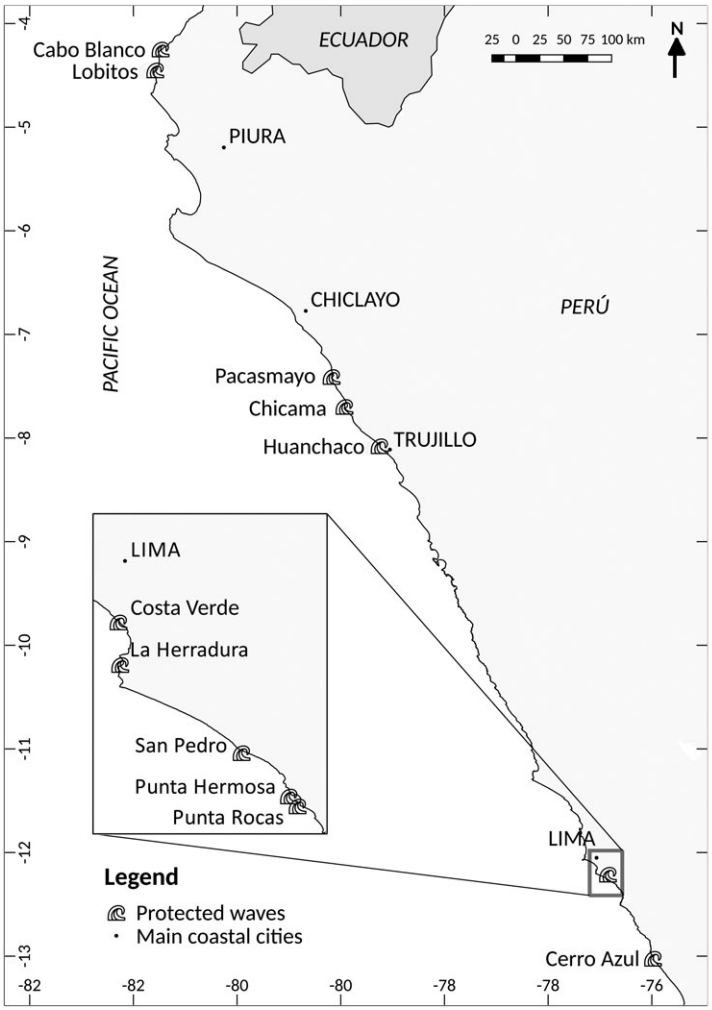
A campaign called HAZla por tu Ola was launched in 2015 by the Peruvian Society for Environmental Law in collaboration with the National Surfing Federation to protect Peru's most important surf breaks via the *Ley de Rompientes*. Through local leaders, the campaign crowdsources the funds to cover the costs of the bathymetric studies and follows up on the administrative processes necessary to register a wave. At the writing of this paper, 27 surf breaks have been protected (Figure 2). Figure 3 shows an example of a protected surf break, La Herradura, and the area that is protected by the *Ley de Rompientes*. A Surf Break Defence Commission of the National Surfing Federation groups experts to help protect threatened waves and represents the interests of surfers in negotiations with authorities and the private sector.

A surf break protected by the *Ley de Rompientes* creates legal restrictions on other use forms in the area, mainly related to infrastructure, oil and gas exploration, and aquaculture concessions, thus de facto protecting benthic habitats, sedimentation processes and the intactness of the seascape. For this reason, in cases where there is significant marine biodiversity that benefits from this form of protection, a protected surf break could qualify as an OECM. Exactly how OECM criteria apply to the *Ley de Rompientes* is illustrated in Table 7.

The *Ley de Rompientes* provides other opportunities for marine conservation in Peru, where changes to environmental regulations and poor relationships between the oil and gas sector have made it extremely difficult for new protected areas to be created—particularly in marine environments. However, since the *Ley de Rompientes* is not based on protected area law, protection via this mechanism is easier to achieve. Although the areas in question are usually small, the law could provide partial protection to areas where there is a surf break and significant biodiversity or seascape, but a protected area is infeasible or the process for protected area creation is paralysed. The latter is the case for the aforementioned Illescas Reserved Zone, which has been awaiting categorization for nearly a decade. Protection via the *Ley de Rompientes* of the area around Punta Malnombre could help protect some of the biodiversity and seascape of the area, while potentially qualifying as an OECM.

4.2.3 | Case study 3: Chile and the TURF–surf model

Chile has no legal framework for the protection of surf breaks; however, the possibility of surf-break protection through Chile's national Territorial Use Rights for Fisheries (TURF) policy is currently being explored by the NGO Fundación Rompientes.



Protected surf breaks	N°. of surf breaks	Area protected (ha)
Cabo Blanco	3	22.14
Cabo Blanco		
Panic Point		
Pico Point		
Lobitos	5	46.46
Piscinas		
Muelles		
Lobitos		
El Hueco		
Baterías		
Pacasmayo	1	117.34
Chicama	1	130.05
Huanchaco	1	82.77
Costa Verde	4	187.76
Punta Roquitas		
La Pampilla		
Makaha		
Redondo		
La Herradura	1	6.93
San Pedro	1	22.75
Punta Hermosa	8	129.01
La Isla		
Kontiki		
El Silencio		
Caballeros		
Señoritas		
Pico Alto		
Playa Norte		
El Paso		
Punta Rocas	1	38.57
Cerro Azul	1	11.73
Total	27	795.53

FIGURE 2 Map showing surf breaks protected by the *Ley de Rompientes* in Peru

FIGURE 3 Map of the La Herradura surf break in Lima, Peru, showing the area protected by the *Ley de Rompientes*

TURFs are concession-based, territorial use rights given to fishing collectives for the co-management of marine resources (Moreno & Revenga, 2014). Through TURFs, the Chilean Undersecretary of Fisheries assigns exclusive benthic resource extraction rights over areas of the sea bed to fishing organizations, who are responsible for developing management plans for the resources and creating

TABLE 7 OECM criteria applied to Peru's "*Ley de Rompientes*" surf break protection mechanism

OECM criteria	Does Peru's *Ley de Rompientes* qualify?	Comments
Geographically defined space	Yes	To protect a surf break, the technical file includes a detailed map, with geographic coordinates and bathymetric properties of the surf break area that is protected.
Not a protected area	Yes	A protected surf break is not considered under the protected area system of Peru. There are specific cases where a surf break is located within a national protected area, as is the case of the San Gallan surf break in the Paracas National Reserve. In principle, both mechanisms could co-exist.
Governed	Yes	The surf break is under the authority of the Peruvian navy, which controls whether other use rights are assigned to the area. Additionally, the Surf Break Defence Commission of the National Surfing Federation is responsible for defending protected surf breaks.
Managed	Yes	The protection measures for the surf break, although not explicitly targeting biodiversity, provide de facto protection by preventing the granting of other use rights over the area.
Long term	Yes	The law protects a surf break indefinitely.
Effective	Yes	The law protects the designated area by effectively blocking the granting of other use rights. It is effective because the navy has sole control over the granting of these rights.
In-situ conservation	Yes	The law protects a specific natural area and the biodiversity that depends on the area.
Biodiversity	Partially—depends on the type of biodiversity in the area	Whereas the law does not require the justification of the importance of the site in terms of its value for biodiversity, the restrictions it generates protect benthic species and the intertidal marine ecosystem from infrastructure projects that could affect them (e.g. seabird nesting areas, marine mammal colonies). The law prohibits aquaculture concessions, but it does not exclude extractive activities that do not affect the bathymetric conditions of the area (e.g. through fishing).
Ecosystem services	Yes	Cultural ecosystem services are maintained because the sport continues to be viable.
Cultural and spiritual values	Yes	The long-standing cultural practice of surfing in Peru goes back to pre-Inca cultures where ancient fishers used the *caballitos de totora* to ride waves. Modern surfing in Peru goes back to the 1950s and, as a sport, is based on the connection with the ocean.

OECM: other effective area-based conservation measure.

monitoring and anti-poaching measures. The Chilean legal framework has changed several times over the last few years, but currently prevents the assignment of conflicting-use rights over TURF areas. TURFs account for more than 1,100 km^2 of the nearshore seascapes in Chile, with an average size of 100 ha each (Gelcich et al., 2010). Importantly, research on TURFs shows that their management measures can allow for the recovery and protection of resources and biodiversity in subtidal communities; specifically, in some cases they increase abundance and size of target species and increase reef-fish biodiversity (Gelcich et al., 2012; Gelcich, Kaiser, Castilla, & Edwards-Jones, 2008). Therefore, TURFs provide ancillary conservation benefits and, given their management structures, could qualify as OECMs (Gelcich et al., 2012).

Recreational activities often overlap with TURFs: surf breaks in particular. This co-existence has led to a growth in recreational activities for fishers, and it is now common to see fishers becoming surfers. These communities are home to a broad range of user groups that rely on healthy environments and vibrant coastal communities. Surf tourism provides fishers with economic opportunities, which strengthen the surfer–fisher relationship and helps make the case for establishing protected surf breaks. A broad sphere of social, cultural, economic and environmental benefits can be maintained when access to surf breaks and TURFs is preserved.

Importantly, TURFs focus on benthic resources, and therefore fishers there also seek to limit infrastructure development that would threaten these resources. Such activities would also impact surf breaks; hence, the interests of surfers and fishers in these areas overlap, albeit for surf breaks for the former and marine resources for the latter. This crossover presents a unique opportunity for joint management schemes.

To assess the potential compatibility of a surf-break protection mechanism integrated with Chile's TURFs, an analysis was conducted to map where such sites overlap along the coast. The analysis was based on a list of key surf breaks listed on www.wannasurf.com, which records surf break location, quality and other features, and the public database on TURFs maintained by the Chilean Undersecretary of Fisheries. The result shows that there are indeed ample cases of overlap between iconic surf breaks and TURFs (Figure 4).

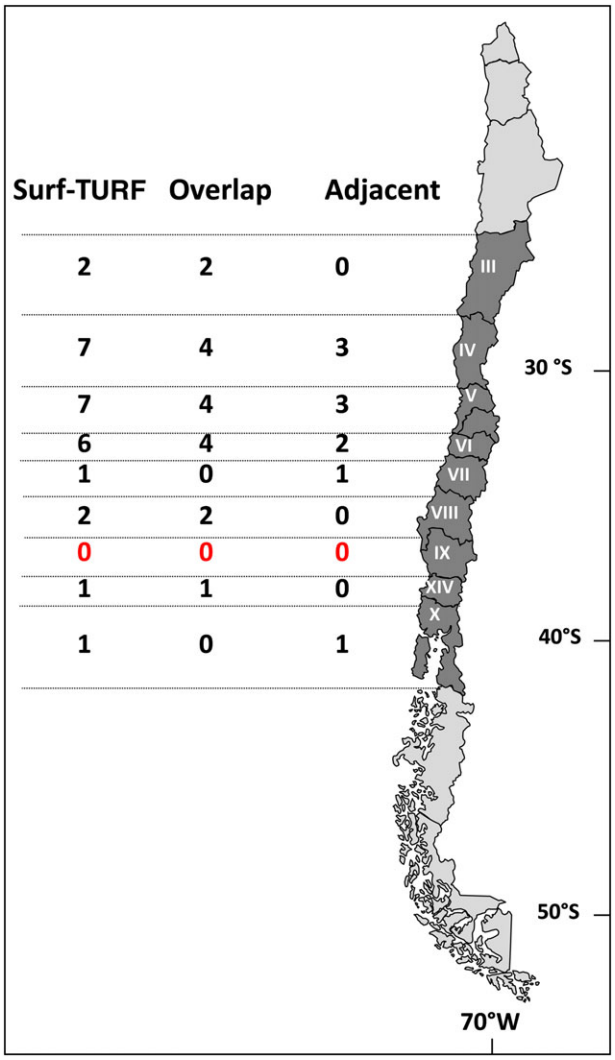


FIGURE 4 Map showing overlap between areas of assigned Territorial Use Rights for Fisheries (TURFs) in Chile, and important surf breaks

Chile's TURF network presents a scalable opportunity to design joint sustainable fisheries and surf-break protection programmes. These 'TURF–surf' models would provide incentives for the protection of marine economic resources, biodiversity and recreational values, while securing public access. Key enabling conditions for governance are created by TURFs, which can be built upon to also include surf breaks in the TURF area. Existing TURFs can provide the foundation for governance, coordination (Crona, Gelcich, & Bodin, 2017), participation, social capital (Marín, Gelcich, Castilla, & Berkes, 2012) and empowerment (Gelcich, Godoy, & Castilla, 2009) for new TURF–surf areas.

Fundación Rompientes, together with fishers and other local partners (i.e. fisher unions, local councils, NGOs and universities), is currently developing the details of this TURF–surf model. Critical factors for success include benefit sharing, shared-governance systems, fishers' capacity to enforce TURF areas, and shared access with surfers. This relationship could take many forms, but should focus on the locally based co-management model of existing TURFs, with surfers as a new stakeholder group.

Furthermore, given the aforementioned evidence that surfing can bring about raised environmental awareness, an interesting secondary benefit of a TURF–surf model could be more positive attitudes towards sustainable resource management among fishers. Through TURF–surf models, one would support and fine-tune a successful, existing policy framework that could benefit surf breaks, fisheries and biodiversity management in Chile.

Given the demonstrated benefits for biodiversity of TURFs, as well as their effective, local area-based management measures, TURF–surf models could also qualify as OECMs once implemented (Table 8). Notably, TURFs are currently not considered protected areas, and hence do not count towards Aichi Target 11.

5 | DISCUSSION

In an increasingly urbanized world, connection with nature is no longer the norm, but something that must be promoted actively by society. In his book *Last Child in the Woods*, Richard Louv (2008) coins the term 'nature-deficit disorder' to describe the psychological, physical and cognitive costs of humanity's increasing disconnection from nature. This paper has discussed some of the growing body of research that demonstrates the benefits to human wellbeing created by spending time in natural environments like the ocean. Surfing should be considered by governments and civil society for its potential for re-engaging citizens with natural marine environments. Meanwhile, given the threats they face, many emblematic surf breaks merit protection for their impact on human wellbeing and their potential for sustainable tourism.

This paper has explored the potential for integrating strategies for surf break protection and marine conservation in cases where these interests overlap. Where possible and appropriate, surf breaks should be considered by governments and civil society when planning protected areas (particularly Categories II, III, V and VI). Meanwhile, existing surf-break protection mechanisms, such as certain instances of WSRs or Peru's *Ley de Rompientes*, may qualify as OECMs when these overlap with areas of high biodiversity and the protection mechanism is based on legal measures. Importantly, the protection measures would have to protect the biodiversity in question as well as the surf break. In the case of OECMs, opportunities exist particularly for benthic conservation targets because surf-break protection measures usually protect against infrastructure and related interventions, although this would still have to be assessed on an individual basis. In cases where such overlap is suspected but not scientifically demonstrated, rapid biological inventories could be commissioned to establish the conservation significance of the site. Surf-break protection could thereby help countries reach international targets for marine conservation.

There are multiple benefits of surfers and environmental groups joining forces. Surfing could provide an important source of sustainable income to protected areas or OECMs by, for instance, regulating tour operator access. Meanwhile, surfers could be a critical mass of support for protected-area proposals, particularly if the management plans

TABLE 8 Other effective area-based conservation measure (OECM) criteria applied to Chile's Territorial Use Rights for Fisheries (TURF)–surf proposal

OECM criteria	Does TURF–surf qualify?	Comments
Geographically defined space	Yes	TURFs are by essence geographically defined (on average 100 ha) and are created by an official decree by the Undersecretary of Fisheries.
Not a protected area	Yes	TURFs are not equivalent to marine protected areas in Chilean legislation.
Governed	Yes	TURFs are under the co-administration of artisanal fishers' unions and the Undersecretary of Fisheries.
Managed	Yes	Fisher unions are required to present a management plan for the creation of the TURF that ensures biodiversity conservation and appropriate extraction measures. This plan must be approved by the pertinent authorities.
Long term	Partially, depends on renewal.	The law allows TURFs to be renewed every 4 years indefinitely. Management areas are subject to an annual monitoring plan that must be submitted by the union. This monitoring plan must include information on harvests, management actions and activity schedule.
Effective	Yes	The protection of benthic habitats has been shown to benefit the whole ecosystem, including reef-fish communities.
In-situ conservation	Yes	The law protects a specific natural area and the biodiversity that depends on the area. Management plans are designed to maintain and ensure viable population of the species.
Biodiversity	Partially	The law does not exclude extractive activities of benthic species that are part of management plans. However, extraction is based on sustainable use criteria.
Ecosystem services	Yes	Research cited above shows a series of ecosystem services have been protected through TURFs, these include provision, cultural and regulation services.
Cultural and spiritual values	Yes	TURFs protect traditional livelihoods. They allow fisher communities to continue with their long-standing traditions of extracting marine resources—sustainably.

include protection of a local surf break. The link between surfing and increased environmental awareness is an opportunity for conservation groups to harness support for marine conservation causes. These could include halting unsustainable coastal development, pushing for plans to reduce single-use plastics, or marine species protection.

Surf-break protection engages many actors that might not usually be involved in conservation. Arroyo et al. (2019) show that WSRs harness the support of a multitude of local stakeholders that can advocate for conservation objectives. In Peru, supporters of surf-break protection have been civilians, municipalities and even the private sector. Private companies sponsored the technical files of several surf breaks that are now protected: the file for La Herradura was paid for by the Quiksilver surf brand, and the file for Chicama was paid for by a local resort. The Patagonia outdoor clothing brand sponsored the entire HAZla por tu Ola surf-break protection campaign, and the making of a film about it (*A la Mar*). Going one step further, a new alliance between Conservation International and Save the Waves underscores the potential of common aims for surfers and the conservation community. There is room for further involvement of the multimillion-dollar surf gear, clothing and apparel industries to support joint surf-break protection and marine conservation efforts.

Meanwhile, the possible negative impacts of surfing have not been discussed in this paper so far, and merit mention here. Davenport and Davenport (2006) review literature on the impacts of tourism and sports such as surfing, diving and use of motorboats on coastal environments. They find that impacts are worrying and range from degradation of natural ecosystems from sheer numbers of tourists, to trampling of intertidal zones such as reefs, to calls for more road access and parking in remote, uninhabited areas to access surf spots. Mentioned also are the many negative impacts of motorboats and personal watercraft, which are used for big-wave surfing, during surf events and to access certain waves. Impacts include noise pollution for cetaceans and collisions with large marine vertebrates such as turtles.

However, virtually all forms of natural resource use cause impacts on biodiversity, and the discussions on human wellbeing versus conservation will inevitably involve hard choices and trade-offs (McShane et al., 2011), balancing conservation aims on the one hand, and human needs on the other. A report by the IUCN (2018) highlights the opportunities of sports for conservation and provides decision-makers with tools to help minimize and mitigate negative impacts of sports on biodiversity. The need for multistakeholder solutions to address these

trade-offs highlights further benefits of joint action between surfers and conservation groups.

Surf breaks included in OECMs or protected areas provide opportunities for minimizing impacts of surfing on the environment. The aforementioned case of San Gallan in Peru is a good example of this, where joint planning between surfers and protected-area authorities have turned previously clandestine surfing into an activity that brings income to the park and is closely regulated to reduce impacts on wildlife. The other example mentioned is the regulation of personal watercraft use at Mavericks, and their prohibition at Ghost Tree and Moss Landing, all surf breaks within the Monterey Bay National Marine Sanctuary. Clear communication is necessary for surfers to understand and comply with such use restrictions, such as designating certain access routes to minimize impacts on reefs, or marking allowed parking areas, to avoid parking on the beach. Surf groups, including NGOs and the private sector, should help socialize a sustainable surfing code of ethics, akin to the principles developed by the Leave No Trace organization in the USA (Leave No Trace, 2012).

More research is needed to identify the sites where surf breaks and areas of high marine or coastal biodiversity overlap; for this, surfers need the conservation community. A further research necessity is a comparative, international review of the different surf-break protection mechanisms that exist, and whether and how these could integrate with marine conservation aims. Alliances between conservation organizations and surfer groups are key to building on the opportunities (and addressing the challenges) that exist at the crossroads between surf-break protection and marine conservation.

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ORCID

Nik Strong-Cvetich https://orcid.org/0000-0002-0120-4115

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