Received: 5 September 2023 | Accepted: 4 September 2024

DOI: 10.1111/reel.12569

ORIGINAL ARTICLE

RECIEL Review of European, Comparative & International Environmental Law | WILEY

Successful conservation and management of kelp forests requires more ambitious use of international law

Erika Techera | Jurgen Valckenaere | Karen Filbee-Dexter | Thomas Wernberg

Correspondence
Erika Techera
Email: erika.techera@uwa.edu.au

Funding information
Australian Research Council, Grant/Award Numbers: DE190100692, DP220100650, LP190100346, LP220200004, FT230100214; Norges Forskningsråd, 335371, 337865

Abstract

Kelp forests are the world's most extensive vegetated marine ecosystems. They provide critical ecological functions as well as valuable ecosystem services for human societies. Yet, kelp forests have been largely overlooked in international environmental law. There are no specific treaties focused on kelp, and they have only benefited to a limited extent under existing regimes. This article analyses the treatment of kelp in international environmental law and finds that there are few formally listed sites containing kelp forests and that several treaty regimes could be better utilised for their benefit. The article concludes by outlining more ambitious ways in which international environmental law can better contribute to the conservation and management of kelp forests and other marine ecosystems facing similar futures. This research seeks to shed light on kelp forests and in doing so seeks to contribute to the growing body of multidisciplinary literature on kelp and the role that law can play in securing its future.

1 | INTRODUCTION

In 2023, the United Nations (UN) Environment Programme (UNEP) published, 'Into the Blue' — a global analysis aimed at comprehensively assessing the status and value of kelp forests worldwide. The Report also provided recommendations for kelp conservation and sustainable management.[1] Relevantly, 'Into the Blue' contains a chapter on kelp forests in law and policy, a focus missing from earlier UNEP publications on marine ecosystems.[2] The overall findings of the Report revealed that kelp forests are located in the waters of 30 States in the world, that kelp forests are diverse and highly productive ecosystems that provide multiple ecological functions and services and that this ecosystem type is threatened by multiple processes and activities.[3] The law and policy findings of the Report were that kelp forests have received relatively little governance attention. The Report found further that existing international frameworks could be more widely used and that further research is needed to identify ways to enhance law and policy for their better conservation and management.[4]

Kelp forests are ecosystems comprised of multiple species of large brown seaweeds that grow on rocky reefs in shallow waters (5 to 40 m depth) in temperate, sub-polar and polar regions of the world.[5] These ecosystems provide a range of crucial ecological

[1]United Nations Environment Programme, *Into the Blue: Securing a Sustainable Future for Kelp Forests* (UNEP 2023) ('*Into the Blue*').
[2]For example, the earlier global analysis of seagrasses did not contain a similar chapter: see, United Nations Environment Programme, *Out of the Blue: The Value of Seagrasses to the Environment and to People* (UNEP, 2020) ('Out of the Blue'). Several other global reports refer to kelp forests trends and pressures as well as the implications of losses: World Ocean Assessment I, Chapter 47: Kelp Forests and Seagrass Meadows (UNGA, *First Global Integrated Marine Assessment* (UN 2016) and HO Pörtner et al (eds), *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* (Cambridge University Press 2019). However, only the UNEP Report, *Into the Blue*, includes a specific chapter on international law and policy to support the conservation and management of kelp forests.

[3]UNEP 2023 (n 1) 5.
[4]ibid, 6-7 and 88.
[5]UNEP 2023 (n 1). This article focuses predominantly on these nations and their engagement with relevant international environmental law.

functions in marine ecosystems, including critical habitats and food for other species, as well as being part of broader food webs.[6] In addition, kelp forests offer valuable ecosystem services for human societies, including food, livelihoods and socio-economic benefits.[7] There are other potential benefits provided by kelp forests such as carbon sequestration, improved coastal water quality and use in production of bioplastics and other materials, and although the full value of kelp for nature-based solutions to climate change is as yet unknown, this is the focus of several ongoing scientific studies.[8] Although kelp forests are the most extensive vegetated marine ecosystems in the world,[9] they are degrading, are facing multiple threats due to anthropogenic activities (such as fishing, dredging and pollution) and are particularly vulnerable to climate change.[10]

The above scientific findings highlight the need for interventions aimed at protecting and sustainably managing kelp forests.[11] Scientists are increasingly calling for action to conserve, manage and restore kelp forests to maintain the benefits they provide[12] and to avoid the consequences of the loss of kelp forests.[13] These appeals have included references to the need for new or revised legal frameworks to secure the future of these ecosystems.[14] Yet few international environmental treaty secretariats have focused attention on kelp forests.[15] At the same time, there appears to be no published scholarship on how international law might be utilised to benefit kelp.[16] Clearly, as most kelp forests are found in relatively shallow coastal waters within the jurisdictions of 30 States, they are largely controlled and managed at the national level. Yet, international treaties can play a role by providing binding rules, common commitments and enforceable protections, as well as targets, incentives and enforcement processes. The associated institutional architecture can support global dialogue, focused programmes of work, data sharing, awareness raising and capacity building. Given the dearth of literature exploring the international legal landscape for kelp forests, there is no foundation for analysing the strengths, weaknesses and potential opportunities international environmental law can offer. The research question that this article addresses is how kelp forests have benefited under international law, where further opportunities lie, and how international law could advance the conservation and management of kelp forests.

The purpose of this article is to build upon, and respond to, the findings of UNEP's 'Into the Blue', in three ways: (1) by providing a more detailed analysis of the ways in which kelp forests currently benefit under international environmental law, (2) by exploring the global treaty regimes that could potentially provide greater support for them and (3) by suggesting ways in which the conservation and management of kelp forests could be advanced. Kelp forests have not historically drawn the level of attention or concern that more aesthetic, visible and well-known marine habitats (such as coral reefs and mangroves forests) have done.[17] This article, therefore, adds to the literature on the conservation and management of kelp forests and also contributes to scholarship on legal protection of marine ecosystems more broadly.[18]

The article commences by providing an overview of international law frameworks for marine ecosystems. This overview highlights the evolution of international law from an initial focus on species to more recent ecosystem approaches that have been, or could be, used to benefit kelp forests. The focus on ecosystems is relevant as the UNEP Report 'Into the Blue' found that an ecosystem-based approach could act as an umbrella under which various management methods could be integrated and applied.[19] The next section maps how existing international laws account for kelp through a desk-based, doctrinal analysis of key international regimes including treaty texts, programmes of work, projects, reports and other materials published on secretariat websites. Thereafter, suggestions are made as to how and where kelp forests could benefit further under international law,

[6]T Wernberg et al, 'Status and Trends for the World's Kelp Forests' in Charles Sheppard (ed), *World Seas: An Environmental Evaluation* (Elsevier 2019) 22.

[7]S Bennett et al, 'The "Great Southern Reef": Social, Ecological and Economic Value of Australia's Neglected Kelp Forests' (2016) 67 Marine and Freshwater Research 47; D Krause-Jensen and CM Duarte, 'Substantial Role of Macroalgae in Marine Carbon Sequestration' (2016) 9 Nature Geoscience 737; K Filbee-Dexter and T Wernberg, 'Substantial Blue carbon in Overlooked Australian Kelp Forests' (2010) 10 Scientific Reports 12341.

[8]Whilst there is some literature on the value of kelp forests as blue carbon, the matter remains contentious among scientists: A Pessarrodona et al, 'Carbon Sequestration and Climate Change Mitigation Using Macroalgae: A State of Knowledge Review' (2023) 98 Biological Reviews 1945; K Filbee-Dexter and T Wernberg (n 7); AM Eger et al, 'The Value of Ecosystem Services in Global Marine Kelp Forests' (2023) 14 Nature Communications 1894. For the most recent scientific literature see: K Filbee-Dexter et al, 'Carbon Export from Seaweed Forests to Deep Ocean Sinks' (2024) 17 Nature Geoscience 552.

[9]A comparison of kelp forest coverage compared with coral reefs, seagrasses, salt marsh and mangroves is set out in Table 1 of T Wernberg et al 'Impacts of Climate Change on Marine Foundation Species' (2024) 16 Annual Review of Marine Science 247. See also, CJ Feehan, K Filbee-Dexter and T Wernberg, 'Embrace Kelp Forests in the Coming Decade' (2021) 373 Science 863; Dinusha RM Jayathilake and MJ Costello, 'Version 2 of the World Map of Laminarian Kelp Benefits from more Arctic Data and Makes it the Largest Marine Biome' (2021) 257 Biological Conservation 109099. Kelp forests cover 25 percent of the world's coastlines: UNEP 2023 (n 1) 5 and 9.

[10]T Wernberg et al, 'Australia's 'other' reef is worth more than $10 billion a year - but have you heard of it?' (The Conversation, 17 August 2015) <https://theconversation.com/australias-other-reef-is-worth-more-than-10-billion-a-year-but-have-you-heard-of-it-45600>; SR Cooley and DS Schoeman (Coordinating Lead Authors) 'Oceans and Coastal Ecosystems and Their Services' in IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Hans-Otto Pörtner et al]; and A Pessarrodona et al, 'Global Seaweed Productivity' (2022) 8 Science Advances eabn2465.

[11]A Vergés and AH Campbell, 'Kelp Forests' (2020) 30 Current Biology R919.

[12]SL Hamilton et al, 'Ecosystem-based Management for Kelp Forest Ecosystems' (2022) 136 Marine Policy 104919.

[13]L Rogers-Bennet and CA Catton, 'Marine Heat Wave and Multiple Stressors Tip Bull Kelp Forest to Sea Urchin Barrens' (2019) 9 Scientific Reports 15050.

[14]S Bennett et al (n 7).

[15]J Valckenaere et al, 'Unseen and Unheard: The Invisibility of Kelp Forests In International Environmental Governance' (2023) 10 Frontiers in Marine Science 1.

[16]One unpublished thesis includes an analysis of international law in the context of broader regional protections for kelp forests: S Dufraing, *Legal Protection of Kelp Forests: A Special Focus on the North-East Atlantic Ocean* (Dissertation submitted to Ghent University 2020-2021) <https://libstore.ugent.be/fulltxt/RUG01/003/007/694/RUG01-003007694_2021_0001_AC.pdf>. Limited published legal scholarship does exist but is focused on national law and policy. For example, L Greenhill, F Sundnes and M Karlsson, 'Towards Sustainable Management of Kelp Forests: An Analysis of Adaptive Governance In Developing Regimes For Wild Kelp Harvesting In Scotland and Norway' (2021) 212 Ocean & Coastal Management 105816; AM Eger et al, 'Global Kelp Forest Restoration: Past Lessons, Present Status, And Future Directions' (2022) 97(4) Biological Reviews 1449.

[17]S Bennett et al (n 7); T Wernberg et al (n 10); and MI Saunders 'Bright Spots in Coastal Marine Ecosystem Restoration' (2020) 30 Current Biology R1500.

[18]The research focuses on naturally occurring kelp forests and not kelp aquaculture.

[19]UNEP 2023 (n 1) 6.

drawing on the legal treatment of other marine ecosystems, primarily coral reefs and mangroves, as exemplars.

2 | THE GLOBAL LEGAL LANDSCAPE FOR MARINE ECOSYSTEMS

There is no international treaty focused purely on conserving and managing marine species or ecosystems. Nevertheless, there are international laws that promote ecosystem-based approaches more broadly, and some global conservation practices and international programmes aim to guide, encourage and promote land or marine ecosystem conservation. These instruments and initiatives are explored, where relevant, in the analysis below. Before progressing to the specific treaties, it is useful to reflect on their historical foundations and how international legal approaches to species, wildlife and natural resources conservation and management have evolved over time. This brief chronological overview is valuable as it provides one explanation for later findings that marine ecosystems are not properly accounted for in international environmental law, and not only have kelp forests 'missed out' within the regimes that do exist, but further opportunities may also lie ahead.

Early global treaties tended to focus on individual species or groups of species — such as whales and birds — often as a reaction to imminent hunting and harvesting pressures.[20] Several later instruments, negotiated during the 1970s, included novel (at the time) terminology and approaches such as the Agreement on the Conservation of Polar Bears which was one of the first to mention 'ecosystems', but squarely in the context of species-based protections:

> Each Contracting Party shall take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns, and shall manage polar bear populations in accordance with sound conservation practices based on the best available scientific data.[21]

Other international wildlife law regimes also continued to take a species-based approach and sought to address specific challenges such as international trade in endangered species[22] and conservation of migratory species which cross multiple jurisdictional boundaries.[23] Other global treaties focused on area-based measures, such as the World Heritage Convention (WHC), which provides a mechanism for global listing of both natural and cultural heritage sites of Outstanding Universal Value and thereafter their protection, conservation, presentation and transmission to future generations.[24] Also, during the 1970s, environmental non-governmental organisations (NGOs) expanded in number and importance. For example, the International Union for Conservation of Nature (IUCN) became the advisory body on natural sites under the WHC.[25] The IUCN is also the organisation that produces the globally accepted assessment of species' status — the Red List of Endangered Species — which is utilised by several species-based treaty regimes.[26]

During this time, one international instrument was adopted that directly focused on habitats: the Ramsar Convention on Wetlands of International Importance.[27] This Convention adopted a wide definition of wetlands that includes freshwater and marine, static and flowing, permanent and temporary bodies of water. Although not referring explicitly to ecosystems, it is highly relevant to kelp forests and, because of this, is explored in greater detail below.

These developments, during the 1970s,were influenced by the rise of the environmental movement and the emergence of international environmental law as a field. For example, the seminal United Nations (UN) Conference on the Human Environment was held in 1972, one outcome of which was the adoption of the Stockholm Declaration comprising core principles of international environmental law.[28] Although not legally binding, the Stockholm Declaration recognised that 'representative samples of natural ecosystems must be safeguarded for … present and future generations'[29] and that the discharge of harmful substances 'must be halted to ensure that serious or irreversible damage is not inflicted upon ecosystems'.[30] This was also a time when the UN Environment Programme (now UN Environment) (UNEP) was established as a global authority on the environment, to monitor the state of the environment and coordinate responses to environmental challenges.[31] UNEP hosts the secretariats of a number of the key international environmental treaties explored below and critically has championed marine ecosystems by commissioning several reports focused on mangroves and coral reefs,[32]

[20]International Convention for the Protection of Birds (adopted 18 October 1950, entered into force 17 January 1963) 638 UNTS 185; and the International Convention on the Regulation of Whaling, International Convention for the Regulation of Whaling (adopted 2 December 1946, entered into force 10 November 1948) 161 UNTS 72 (ICRW)..

[21]Agreement on the Conservation of Polar Bears (adopted 15 November 1973, entered into force 26 May 1976) 13 ILM 1974, art II.

[22]Convention on International Trade in Endangered Species of Wild Fauna and Flora (adopted 3 March 1973, entered into force 1 July 1975) 993 UNTS 243 (CITES).

[23]Convention on the Conservation of Migratory Species of Wild Animals (adopted 23 June 1979, entered into force 1 November 1983) 1651 UNTS 333 (CMS).

[24]Convention for the Protection of the World Cultural and Natural Heritage (adopted 16 November 1972, entered into force 17 December 1975) 1037 UNTS 151 (WHC).

[25]The IUCN is specifically referred to in arts 8, 13 and 14 of the WHC.

[26]IUCN, Red List of Threatened Species, < https://www.iucnredlist.org/>.

[27]Convention on Wetlands of International Importance especially as Waterfowl Habitat (adopted 2 February 1971, entered into force 21 December 1975) 996 UNTS 245 (Ramsar Convention).

[28]Stockholm Declaration on the Human Environment, 16 June 1972, UN Doc A/CONF.48/14 (1972).

[29]Principle 2.

[30]Principle 6.

[31]UN Environment Programme, About the United Nations Environment Programme <https://www.unep.org/about-us>. UNEP hosts the secretariats of a number of key international environmental treaties including the Convention on Biological Diversity (CBD) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the Regional Seas Conventions (and current negotiations for a global plastics treaty are being supported by UNEP), as well as institutions including Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC) (as co-host): UN Environment Programme, Secretariats and Conventions (MEAs) <https://unep.org/about-un-environment/why-does-un-environment-matter/secretariats-and-conventions>.

[32]UN Environment Programme, Status of Coral Reefs of the World Report: 2020 (UNEP, 2020), M Hein et al, *Coral Reef Restoration as a strategy to improve ecosystems services: A Guide to Coral Restoration Methods* (UNEP 2020), and UNEP, *The Importance of Mangroves to People: A Call to Action* (UNEP WCMD 2014).

as well as the global report on seagrasses[33] and the first such report on kelp.[34]

At the end of the 1970s, negotiations were concluding on what became the United Nations Convention on the Law of the Sea (UNCLOS).[35] A key feature of UNCLOS is the settling of maritime zones, including state-controlled waters (the territorial sea [0–12 nautical miles from the coast] and exclusive economic zone [EEZ] 12–200 nautical miles) and remaining high seas areas beyond national jurisdiction. These are relevant as kelp forests, and the majority of other marine ecosystems considered in this article, occur primarily in national waters. There are several other provisions of UNCLOS that relate broadly to marine conservation. For example, UNCLOS provides that all States '… have the obligation to protect and preserve the marine environment'[36] and obligations to prevent, reduce and control pollution.[37] The only provision of UNCLOS specifically referring to ecosystems is Article 194(5) requiring parties to take measures 'to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species' from marine pollution. Broader pollution provisions are also relevant, for example Article 211(6) permitting coastal States to establish additional laws to prevent, reduce and control pollution from vessels to protect resources in specific areas and based on particular ecological conditions. More fundamentally, the whole of Part XII UNCLOS is relevant as the provisions create general obligations — including the Article 192 requirement to protect and preserve the marine environment — the meaning of which interacts with and has evolved in light of international environmental law treaties concluded earlier and later.[38]

One of the most recent developments under UNCLOS is the adoption of the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ Agreement). The BBNJ Agreement seeks to 'ensure the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction'.[39] Scientific studies show that kelp forests are predominantly found in shallow waters relatively close to shore, and it is unclear to what extent they are found in the high seas or on the seabed beneath it.[40] In these circumstances, the BBNJ Agreement is likely to be of limited potential benefit when it comes into force.

States are required to cooperate at the regional level under UNCLOS (e.g. Article 197), and it is UNEP that has championed developments through a collaborative approach for nations sharing common bodies of water. UNEP works at the regional level to support marine and coastal protection, through the Regional Seas Programme (RSP), regional fishery bodies and the large marine ecosystem (LME) approach. Beyond general provisions for marine and coastal protection, some of these RSPs and supporting Action Plans include provisions requiring member States to take necessary measures to conserve marine ecosystems and areas.[41] One of the most significant RSPs, for example, covers the North East Atlantic.[42] The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) includes Annex V relating to the protection and conservation of ecosystems and restoration of marine areas including through collecting and reviewing information and applying integrated management actions. The LME approach supports ecosystem-based management by identifying and holistically managing these productive coastal waters. To date, 66 LMEs have been identified worldwide and funding is provided through the Global Environment Facility (GEF) to support multi-lateral collaborative governance of these transboundary areas.[43] Relevant temperate areas include the Norwegian Shelf and the West-Central Australian Shelf. In addition, UNEP has been mandated to support the implementation of ecosystem-based adaptation to climate change since 2010.[44]

International law to address pollution from ships was also advanced during the 1970s, led by the International Maritime Organisation (IMO). Although the principal treaty — International Convention for the Prevention of Pollution from Ships (MARPOL)[45] — does not mention ecosystems, several relevant area-based measures provide a higher level of protection for certain ocean spaces. In particular, places of ecological significance can be declared under MARPOL as 'special areas' (where mandatory methods to prevent pollution must be applied) and the IMO can designate 'particularly sensitive sea areas' (PSSAs) (where special protection is needed due to vulnerability). The latest guidelines for PSSAs define ecological criteria as including unique or rare ecosystems, critical habitats that support LMEs, ecosystems that are dependent on structuring organisms and representative and diverse ecosystems.[46]

Over time, international environmental law evolved to encapsulate biological diversity, with reference to ecosystems in the broader context of species and genetic resources. The most prominent

[33]UNEP 2020 (n 2).
[34]UNEP 2023 (n 1).
[35]United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 3 (UNCLOS).
[36]UNCLOS art 192.
[37]For example, UNCLOS art 194.
[38]This was a finding in the South China Sea Arbitration: see C Kojima, 'South China Sea Arbitration and the Protection of the Marine Environment: Evolution of UNCLOS Part XII Through Interpretation and the Duty to Cooperate' (2015) 21 Asian Yearbook of International Law 166–180.
[39]UNGA Resolution, *Agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction* A/CONF.232/2023/4 (19 June 2023), art 2.
[40]UNEP 2023 (n 1).
[41]UNEP, Regional Seas Programme <https://www.unep.org/topics/ocean-seas-and-coasts/regional-seas-programme>.
[42]For example, Convention for The Protection of The Marine Environment of The North-East Atlantic (adopted 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67 (OSPAR Convention) art 2. See also, United Nations Environment Programme, *Contributions of Regional Seas Conventions and Action Plans to a Healthy Ocean* (UNEP 2022) ttps://wedocs.unep.org/bitstream/handle/20.500.11822/38622/Regional_Seas_Conventions.pdf
[43]GEF, Large Marine Ecosystems <https://www.thegef.org/what-we-do/topics/international-waters/marine/large-marine-ecosystems>.
[44]United Nations Environment Programme, *A Decade of Ecosystem-based Adaptation: Lessons from the United Nations Environment Programme* (UNEP 2024).
[45]International Convention for the Prevention of Pollution from Ships (adopted 2 November 1973, entered into force 2 October 1983) 12 ILM 1319, as modified by the Protocol of 1978 to the 1973 Convention, 1341 UNTS 3 (MARPOL).
[46]IMO, *Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas*, A 24/Res.982 (6 Feb 2006).

instrument in this regard is the Convention on Biological Diversity (CBD).[47] Relevantly, the CBD refers explicitly to ecosystem functions and services, as well as restoration:

> Each Contracting Party shall as far as possible and as appropriate:
>
> ...
>
> (d) Promote the protection of ecosystems, ...
>
> ...
>
> (f) Rehabilitate and restore degraded ecosystems ...[48]

One particular CBD initiative is the recognition of the special importance of Ecologically or Biologically Significant Marine Areas (EBSAs) based on seven scientific criteria — uniqueness or rarity; special importance for life history stages of species; importance for threatened, endangered or declining species and/or habitats; vulnerability, fragility, sensitivity or slow recovery; biological productivity; biological diversity; and naturalness.[49] Over 320 EBSAs have been described in 76% of the world's ocean, including some containing kelp forests as will be seen below.[50] Once identified, EBSAs can be used to inform national conservation and management planning.

The CBD is a more sophisticated regime than many earlier conventions and frameworks, not only in because of its conservation and management scope and approaches but also in terms of provisions that support implementation. For example, it requires national reports to be submitted to the Secretariat and the development of national strategies, plans and programmes by Member States.[51] These documents provide a valuable resource for other Member States and allow for assessment of whether collectively these goals are likely to be met as well facilitating long-term monitoring of biodiversity conservation interventions. These are important for the achievement of the Kunming-Montreal Global Biodiversity Framework (GBF) adopted in 2022.[52] These additional elements, although non-binding, provide goals and incentives for biodiversity conservation and are particularly powerful given the high number of ratifications of the CBD.

Two further streams of international law of relevance have emerged and one institution. The first is global climate change law, which has drawn attention to ecosystem services that can facilitate climate change mitigation and adaptation. The Paris Agreement has catalysed the preparation of non-binding national mitigation and adaptation commitments and plans (nationally determined contributions [NDCs]) by Member States which can include nature-based solutions to climate change involving marine ecosystems.[53] The blue carbon and the carbon sequestration potential of marine ecosystems is relevant to mitigation actions, and the ability to absorb wave energy, protect coasts and reduce erosion is relevant to adaptation. As noted above, scientific studies are continuing in relation to this potential, and the Paris Agreement, and initiatives it catalyses, has the potential to utilise this knowledge.

The second is the rise of soft law and global policy instruments independent of specific treaty regimes, whilst not legally binding they can be highly influential. In addition to the Stockholm Declaration referred to above, the Rio Declaration and Agenda 21, adopted at the UN Conference on Environment and Development in 1992, were both relevant to marine ecosystems.[54] The Rio Declaration reiterated many principles set out in the Stockholm Declaration and added Principle 7 calling upon States to cooperate to conserve, protect and restore the Earth's ecosystem. Agenda 21 was an action plan which included a whole chapter on oceans and in particular called on States to identify and restrict the use of marine ecosystems 'exhibiting high levels of biodiversity and productivity and other critical habitat areas'.[55]

The Sustainable Development Goals (SDGs), an outcome of the Rio+20 Conference, provide important support for marine ecosystem conservation, management and restoration.[56] Most significant is SDG14 Life Below Water and in particular SDG 14.2:

> sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

Marine ecosystems may also benefit from SDG13 Climate Action and, where related to food and livelihoods, SDG1 End Poverty and SDG2 Zero Hunger. The SDGs have had considerable influence, catalysing voluntary commitments by States, private industry, communities and individuals and leading to some progress, yet the latest reports indicate that action has been fragile and too slow with only 12% on track.[57] Further support is evident from the work of the UN High-level Political Forum on Sustainable Development.[58]

More recently, a group of States have joined together to form the High Level Panel for A Sustainable Ocean Economy (Ocean Panel). The Joint Declaration on Ocean and Climate Action (2023) demonstrates an ongoing commitment to improving the health of the ocean

[47]Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79 (CBD).
[48]CBD art 8.
[49]CBD, 'Background on the EBSA Process' <https://www.cbd.int/ebsa/about>.
[50]The Global Ocean Biodiversity Initiative, 'EBSA' <https://gobi.org/ebsas/>.
[51]CBD arts 6 and 26.
[52]Convention on Biological Diversity, *Kunming-Montreal Global Biodiversity Framework* <https://www.cbd.int/gbf/>.
[53]Paris Agreement to the United Nations Framework Convention on Climate Change (adopted 12 December 2015, entered into force 4 November 2016) 55(4) ILM 740 (Paris Agreement).
[54]UNGA, Rio Declaration on Environment and Development, UN Doc. A/CONF.151/26 (Vol. 1), 31 ILM 874 (1992) (Rio Declaration); and Report of the United Nations Conference on Environment and Development, GAOR, 46th Session, Agenda Item 21, UN Doc. A/CONF.151/26 (1992) (Agenda 21).
[55]Agenda 21 para 17.85
[56]Transforming Our World: The 2030 Agenda for Sustainable Development, UN Doc A/Res/70/1,
25 September 2015, Goal 14: Conserve and sustainably use the oceans, seas and marine resources
<https://www.un.org/sustainabledevelopment/oceans/>; and United Nations, 'SDG 14: Overview' <https://sdgs.un.org/goals/goal14>.
[57]UNGA, *Progress towards the Sustainable Development Goals: Towards a Rescue Plan for People and Planet* A/78/xx-E/2023/xx <https://sdgs.un.org/sites/default/files/2023-04/SDG_Progress_Report_Special_Edition_2023_ADVANCE_UNEDITED_VERSION.pdf>.
[58]UN, *UN High-level Political Forum on Sustainable Development* < https://hlpf.un.org/>.

including through accelerated action.[59] The Declaration builds on the Ocean Panel's Transformations for a Sustainable Ocean Economy agenda that commits to Sustainable Ocean Plans for all marine areas under the national jurisdiction.[60] To advance this agenda, a report was prepared to synthesise the scientific knowledge and identify options for action.[61] That report contains multiple references to marine ecosystems, including kelp, in the context of climate change mitigation, coastal protection and blue carbon pathways, as well as conservation and restoration of marine fauna and the achievement of SDGs, together with an assessment of financing needs and readiness options. These contemporary developments demonstrate ongoing commitments to improving the health of marine ecosystems.

The above short summary highlights the wealth of laws and initiatives focused upon marine ecosystems that together could provide harmonised approaches for kelp conservation and management. Before exploring the challenges, and suggesting reform options, the next section maps and analyses the current legal landscape of specific relevance to kelp forests. As a first step, Table 1 below sets out the 30 States in whose waters kelp forests are found and their ratification of relevant treaties referred to above.

3 | KELP IN INTERNATIONAL ENVIRONMENTAL LAW

As noted above, multiple treaty regimes provide for marine ecosystem protection and are therefore relevant to the conservation and management of kelp forests. UNCLOS provides fundamental obligations to protect and preserve the marine environment yet does not include mechanisms for listing kelp species or processes for declaring protected areas. Nonetheless, the Convention is a living instrument and its provisions must be interpreted in light of other instruments including specific environmental conventions.[62] It is under these other international environmental regimes that sites containing kelp forests have been listed. The sections that follow explore the three treaties and mechanisms that explicitly recognise designated sites containing kelp forests: Ramsar Convention, WHC and IMO PSSAs. In addition, NDCs submitted in accordance with the Paris Agreement, CBD-related national reports and National Biodiversity Strategies and Action Plans (NBSAPs) and other CBD initiatives, including EBSAs, are examined to identify those that refer to kelp. The inclusion of kelp forests in instruments and initiatives under Multilateral Environmental Agreements indicates awareness by governments that there are kelp forests needing some protection. Such inclusion also provides the recognition of the value and the importance of these areas, as well as commitments to conservation in response to threats and impacts. Table 2 sets out a summary of all references to kelp forests in the regimes explored in Section 2.

3.1 | Ramsar wetlands

As outlined in Section 2, the Ramsar Convention focuses specifically on the conservation and management of wetland habitats. It is relevant for kelp forests as it is one of the international law regimes under which kelp forests have been explicitly mentioned in sites listed for protection.

Wetlands are defined as ' … including areas of marine water the depth of which at low tide does not exceed six metres'.[63] This provision, even if it includes kelp at some sites, is likely to only encompass a portion of these ecosystems as kelp forests often extend from the lower intertidal zone to 20 or 30 m depth.[64] Obligations under the Convention are for each Contracting Party to designate at least one wetland in its territory for inclusion in the List of Wetlands of International Importance.[65] These wetlands should be selected for listing because of their 'international significance in terms of ecology, botany, zoology, limnology or hydrology.'[66] Article 4(1) requires Contracting Parties to promote the conservation of wetlands, establishment of nature reserves on designated wetlands and to ' … provide adequately for their wardening'. Where the boundaries of the wetland are restricted, in its urgent national interest, a contracting party should ' … as far as possible compensate for any loss of wetland resources … [and] create additional nature reserves …'. However, Article 3.1 binds parties to '… promote the conservation of the wetlands …, and as far as possible the wise use of wetlands in their territory', and Article 3.2 requires States to monitor changes in 'ecological character of any wetland in its territory.' Although the treaty does not include definitions for 'conservation', 'wise use' or 'ecological character', the subsequent Handbook on Wise Use of Wetlands, recognises that the phrase 'environmental conservation has evolved and changed' refers to the ecosystem approach, sustainable use and development, as well as restoration, and notes that wise use 'equates with the maintenance of ecosystems and the continued delivery of ecosystem services to maintain human well-being'.[67]

The analysis of sites designated under the Ramsar Convention reveals 45 relevant sites[68]:

1. Eight wetland areas where kelp ecosystems are acknowledged in the Ramsar listing (in the United Kingdom, South Africa, Portugal, Japan, Norway);

[59]High Level Panel for A Sustainable Ocean Economy, *Joint Declaration on ocean and climate action* (2023) <https://oceanpanel.org/wp-content/uploads/2023/12/Joint-Ocean-Action-Declaration_v1.docx-1.pdf>. 11 of the 19 panel members are States with temperate waters containing kelp forests.
[60]High Level Panel for A Sustainable Ocean Economy, *Transformations for a Sustainable Ocean Economy: A Vision for Protection, Production and Prosperity* <https://oceanpanel.org/wp-content/uploads/2022/06/transformations-sustainable-ocean-economy-eng.pdf>.
[61]O Hoegh-Guldberg and E Northrop, *The ocean as a solution to climate change: Updated opportunities for action* (World Resources Institute 2023) <https://oceanpanel.org/publication/ocean-solutions-to-climate-change>.
[62]Kojima (n 38) 170.
[63]Ramsar Convention art 1(1).
[64]T Wernberg et al (n 10).
[65]Ramsar Convention, art 2(1).
[66]Ramsar Convention, art 2(2).
[67]Ramsar Convention Secretariat, *Wise Use of Wetlands: Concepts and Approaches for the Wise Use of Wetlands* (Ramsar handbooks for the wise use of wetlands, 4th edn, Ramsar Convention Secretariat 2010) 6.
[68]See Table 2 for further details.

TABLE 1 All States in whose waters kelp are found,[a] and their membership of key treaty regimes.[b]

	Key global treaty ratifications					
State	UNCLOS	Ramsar Convention	WHC	MARPOL (Annex I and II)	UNFCCC/PA	CBD
Argentina	X	X	X	X	X	X
Australia	X	X	X	X	X	X
Brazil	X	X	X	X	X	X
Canada	X	X	X	X	X	X
Chile	X	X	X	X	X	X
China	X	X	X	X	X	X
Denmark	X	X	X	X	X	X
Ecuador	X	X	X	-	X	X
France	X	X	X	X	X	X
Germany	X	X	X	X	X	X
Iceland	X	X	X	X	X	X
Ireland	X	X	X	X	X	X
Italy	X	X	X	X	X	X
Japan	X	X	X	X	X	X
Democratic People's Republic of Korea	signed	X	X	X	-	X
Republic of Korea	X	X	X	X	X	X
Mexico	X	X	X	X	X	X
Morocco	X	X	X	X	X	X
Mozambique	X	X	X	X	X	X
Namibia	X	X	X	X	X	X
New Zealand	X	X	X	X	X	X
Norway	X	X	X	X	X	X
Peru		X	X	X	X	X
Portugal	X	X	X	X	X	X
Russian Federation	X	X	X	X	X	X
South Africa	X	X	X	X	X	X
Spain	X	X	X	X	X	X
Sweden	X	X	X	X	X	X
United Kingdom	X	X	X	X	X	X
United States		X	X	X	X	Signed

[a]Information accessed from UNEP 2023 (n 1).
[b]Information accessed from individual treaty websites: Ramsar: <www.ramsar.org>, World Heritage Convention: <www.whc.unesco.org>, Convention on Biological Diversity: <www.cbd.int>, and United Nations Framework Convention on Climate Change: <www.unfccc.int>.

2. Twenty other sites where kelp are not directly referred to in the Ramsar listing but where kelp was mentioned in the submission (including Peru, New Zealand, Argentina, Chile, Canada, United Kingdom, South Africa, Spain, Denmark);
3. Seventeen further listed sites where kelp forests are not referred to specifically but where environmental conditions and the scientific literature may suggest the presence of kelp (including the United States, Australia, Denmark, Ireland, Russia, Sweden and Norway).

None of these areas have been proposed for listing specifically because of the presence of kelp. However, as kelp is still included within the areas, it will benefit from the conservation practices triggered by Article 3. Nevertheless, kelp forests are best protected under this treaty where they are explicitly referred to in the listing. In other cases, arguably, if the kelp forests do not form part of the reason for the area's selection therefore loss of, or damage to, the kelp may not be considered relevant to the resilience or integrity of these ecosystems. Therefore, these species may not be conserved or wisely used, and the ecological character may not be monitored.

The Ramsar Convention regime has not directly engaged with kelp forest conservation and management. Neither kelp nor seaweed more generally are mentioned, for example, in the Ramsar Briefing Note State of the World's Wetlands and their Services to People

TABLE 2 References to kelp in key treaty listings and documents.[a]

	RAMSAR site		WHC		IMO/MARPOL	Regional Seas	Paris Agreement	CBD		
STATE	**Specific mention of kelp in site listing and/or submission documentation**	**Other listed sites believed to contain kelp**	**Specific mention of kelp in site listing and/or nomination documentation**	**Other listed sites believed to contain kelp**	**PSSAs in temperate waters believed to contain kelp**	**Regional Seas Convention areas believed to contain kelp**	Specific mention of kelp or seaweed in the NDC submission	**EBSAs believed to contain kelp**	**Mention of kelp in any national report**	**Mention of kelp in National Biodiversity Strategy and Action Plan (NBSAP)**
Argentina	1 site		1 site							
Australia		2 sites	1 site	1 site					1 reference to kelp	
Brazil										
Canada	1 site		1 site (with US)						3 references to kelp	
Chile	1 site							1 site		
China									1 reference to kelp and 4 to seaweed	
Denmark	1 site	3 sites	1 site (with Germany and Netherlands)		1 site			2 sites		
Ecuador				1 site	1 site					
France			1 site		1 site					
Germany			1 (with Denmark and Netherlands)		1 site			1 site		
Iceland			1 site							
Ireland		1 site			1 site				1 reference to kelp and 1 reference to seaweed	
Italy										
Japan	1 site		1 site						1 reference to kelp and 7 to seaweed	
Democratic People's Republic of Korea										8 references to seaweed
Republic of Korea										
Mexico										

TABLE 2 (Continued)

STATE	RAMSAR site		WHC		IMO/MARPOL	Regional Seas	Paris Agreement	CBD		
	Specific mention of kelp in site listing and/or submission documentation	Other listed sites believed to contain kelp	Specific mention of kelp in site listing and/or nomination documentation	Other listed sites believed to contain kelp	PSSAs in temperate waters believed to contain kelp	Regional Seas Convention areas believed to contain kelp	Specific mention of kelp or seaweed in the NDC submission	EBSAs believed to contain kelp	Mention of kelp in any national report	Mention of kelp in National Biodiversity Strategy and Action Plan (NBSAP)
Morocco										
Mozambique							1 reference to seaweed			
Namibia							1 reference to kelp		1 reference to kelp	
New Zealand	1 site		1 site							
Norway	7 sites	6 sites		1 site					10 references to kelp	
Peru	1 site				1 site					
Portugal	1 site				1 site					
Russian Federation		1 site		1 site				4 sites		
South Africa	3 sites			1 site				1 site	1 reference to kelp	
Spain	1 site				2 sites					
Sweden		3 sites	1 site (with Finland)					1 site		
United Kingdom	9 sites		1 site	1 site	1 site					
United States		1 site	1 site (with Canada)							

[a]Information accessed from individual treaty websites: Ramsar: <www.ramsar.org>, World Heritage Convention: <www.whc.unesco.org>, Convention on Biological Diversity: <www.cbd.int>, and United Nations Framework Convention on Climate Change <www.unfccc.int>.

(2015)[69] and only once (in the context of blue carbon) in the Global Wetland Outlook (2021).[70] This is in stark contrast to other marine and coastal ecosystems — such as coral reefs, mangroves and seagrass meadows — which are referred to numerous times in both documents.[71] Furthermore, the Ramsar Convention has championed initiatives focused on other marine ecosystems, such as the Mangrove Action Project and the Regional Initiative for the Integral Management and Wise Use of Mangroves and Coral Reefs Ecosystems.[72] The effect of this omission of kelp forests is compounded where other coastal ecosystems benefit from collaborative initiatives including where the Ramsar Convention has partnered with other international organisations. For example, Ramsar joined the international partnership for Blue Carbon which is focused on seagrass meadows, mangrove forests and salt marshes, but not on kelp forests.[73] No doubt, similar initiatives could be developed to benefit kelp forests building on the knowledge and experience gained regarding coral reefs and mangroves.

3.2 | World Heritage sites

The WHC is the second global treaty that has triggered the listing of sites that include kelp forests. As outlined in Section 2, the Convention focuses on the protection, conservation, presentation and transmission of natural and cultural areas of outstanding universal value. Article 2 provides a framework for Member States to nominate sites for listing, including those with 'natural features consisting of … biological formations … which are of outstanding universal value from the aesthetic or scientific point of view' or 'natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty'. Outstanding universal value (OUV) is not defined in the treaty but is explained further in The Operational Guidelines for the Implementation of the World Heritage Convention:

> [OUV] means … natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole.[74]

Once listed, Article 4 (a)–(e) requires member States to promote conservation, anticipate threats and in necessary cases '… to take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage …'.

The analysis of WH listings reveals that 16 World Heritage sites are relevant for kelp forests:

1. One World Heritage site specifically highlights kelp in its listing (Japan);
2. Nine additional sites acknowledge kelp as in the area (in Argentina, France, Australia, United States, Iceland, Denmark/Germany/Netherlands, Finland/Sweden and United Kingdom);
3. Six additional World Heritage sites contain kelp systems (UK, South Africa, France, Australia, Russian Federation, Norway and Ecuador); and
4. Kelp are also highlighted as part of several sites on the Tentative List (including some sites on the Tentative list: Breiðafjörður Nature Reserve in Iceland, Hazar State Nature Reserve in Turkmenistan and the California Current Conservation Complex, USA).[75]

Whilst none of the Member States directly used the kelp forests as a criterion for World Heritage list nomination, 10 describe kelp forests as an important part of the site.[76] It is critical, however, that the kelp forests are included as part of the criteria for which the site has been listed; otherwise, these ecosystems might not benefit fully from the World Heritage listing. Therefore, global efforts to encourage States to formally recognise the presence of kelp forests and to include them as part of the OUV would be useful. The WH Committee has produced specific publications[77] and hosted events focused on coral reefs.[78] In addition, publications such as 'UNESCO Marine World Heritage: Custodians of the Globe's Blue carbon Assets' highlight other coastal ecosystems, but again, kelp forests are neglected.[79] As with the Ramsar Convention Secretariat, the World Heritage Committee could also expand its focus on marine ecosystems to include kelp forests.

3.3 | IMO PSSAs

As part of international laws to address shipping, and vessel-sourced pollution, the IMO has designated particularly sensitive seas areas that include places where kelp forests are found. The PSSAs protect the marine environment in these places through measures such as

[69] RC Gardner et al, *State of the World's Wetlands and Their Services to People: A compilation of recent analyses* (Ramsar Convention Secretariat 2015).
[70] Convention on Wetlands, *Global Wetland Outlook: Special Edition 2021* (Secretariat of the Convention on Wetlands 2021) 47.
[71] Coral and/or reefs are mentioned over 10 times, mangroves nine times, and seagrass five times, in Gardner et al (n 72). In the *Global Wetland Outlook* (n 73), coral and/or reefs are mentioned nine times, mangroves six times, and seagrass five times.
[72] MAP, *Mangrove Action Project* <https://mangroveactionproject.org/>; Ramsar Convention Secretariat, *Regional Initiative for the Integral Management and Wise Use of Mangroves and Coral Reefs* <https://www.ramsar.org/sites/default/files/documents/library/americas_mangroves_en.pdf>.
[73] Ramsar Convention Secretariat, *Ramsar Convention joins the International Partnership for Blue Carbon*, (14 September 2017) <https://www.ramsar.org/news/ramsar-convention-joins-the-international-partnership-for-blue-carbon>.
[74] UNESCO, *Operational Guidelines for the Implementation of the World Heritage Convention* (WHC.21/01, 31 July 2021) <https://whc.unesco.org/en/guidelines/>.
[75] WHC, 'World Heritage List': <https://whc.unesco.org/en/list/>.
[76] ibid.
[77] WHC, *World Heritage Coral Reefs*: <https://whc.unesco.org/en/news/1713>; *Regional Initiative for the Integral Management and Wise Use of Mangroves and Coral Reefs* (n 75).
[78] Ministry of Culture of the Republic of Azerbaijan, *Building Leadership for Climate Adaptation of Coral Reefs* (UNESCO 2019): <https://whc.unesco.org/en/documents/176243>.
[79] UNESCO, *Custodians of the globe's blue carbon assets*: <https://library.sprep.org/sites/default/files/2021-03/custodians-globe-blue-carbon-assests.pdf>.

avoidance of the area by vessels or mandatory deep water shipping routes. None of the public documents associated with the designation of the PSSAs refers explicitly to kelp, although the resolution relating to the Paracus Nature Reserve does mention seaweed.[80] Several other PSSAs are relevant as they cover temperate waters where kelp are believed to be found. These PSSAs include the Western European Waters,[81] Wadden Sea,[82] Canary Islands[83] and Galapagos Archipelago.[84] Clearly, as area-based measures, the PSSAs protect not only individual species but also whole marine ecosystems.

3.4 | Regional Seas Programme

The UNEP Regional Seas Programmes, outlined in Section 2, are aimed at marine and coastal environmental protection which could benefit kelp forests because they cover places where these ecosystems are known to exist. The most relevant RSPs for kelp forests (as they cover temperate waters) are in the North East Atlantic, Antarctic, East Asian Seas, North West Pacific, West and Central Africa and South East Pacific. None of these RSPs mentions kelp or has initiatives focused on this particular marine ecosystem, although several include initiatives under which kelp forests might benefit.

As noted above, the OSPAR Convention in the North East Atlantic is focused on protecting the marine environment and includes annexes focused on specific goals.[85] Annex V on protection and conservation of ecosystems and restoration of marine areas no doubt benefits kelp, but this ecosystem does not appear to be mentioned in any documentation. Relevantly, several documents of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) note the presence of kelp in waters off South Georgia[86] and Kerguelen Islands.[87] There is no reference to kelp being found in the Ross Sea marine protected area (MPA) nor are there conservation measures in force that mention kelp.[88] The South East Pacific RSP is supported by the Permanent Commission on the South Pacific and the South East Pacific Action Plan.[89] Relevantly, there is a Convention for the Protection of the Marine Environment and the Coastal Zone of the Southeast Pacific (1981) and Protocol for the Conservation and Administration of Marine and Coastal Protected Areas of the Southeast Pacific (1989), plus a Regional Action Plan for the Conservation of Mangroves of the Southeast Pacific (2021–2025) but no similar initiative for kelp forests. The North West Pacific RSP includes an Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP).[90] The NOWPAP goals include preventing degradation of the marine environment and facilitating recovery with a focus is on monitoring, pollution and oil spill continency planning.[91] The Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West and Central Africa Region (Abidjan Convention) has led to the adoption of five further protocols including the Protocol on Integrated Coastal Zone Management and the Protocol on Sustainable Mangrove Management.[92] The East Asian Seas RSP includes a Coordinating Body on the Seas of East Asia (COPBSEA) and an Action Plan for the Protection and Development of the Marine Environment and Coastal Areas of the East Asian Region.[93] Similarly, there is a strong focus on marine pollution and litter in particular and strengthening ecosystem-based marine and coastal planning and management focusing on MPAs.[94]

3.5 | NDCs under the Paris Agreement

As outlined in Section 2, the climate change regime, including the Paris Agreement, is of growing importance for kelp forests as their carbon sequestration value is better understood and increasingly recognised. In particular, the Paris Agreement seeks to enhance the implementation of the UNFCCC by strengthening the global mitigation and adaptation response to climate change.[95] The only binding obligation under the Paris Agreement is for Member States to submit a NDC document which communicates the domestic mitigation and adaptation measures.[96] Of the 193 parties to the Paris Agreement, all have submitted at least one NDC, and several have updated or second versions, including all 30 nations where kelp forests are found.[97] An

[80]IMO, *Resolution MEPC.106(49) Designation of the Paracas National Reserve as a Particularly Sensitive Sea Area* <https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MEPCDocuments/MEPC.106(49).pdf>.
[81]Netherlands Regulatory Framework (NeRF) – Maritime, *121(52) Designation of the Western European Waters as a Particularly Sensitive Sea Area* <https://puc.overheid.nl/nsi/doc/PUC_1517_14/1/>
[82]Common Wadden Sea Secretariat, *PSSA Wadden Sea Operational Plans* <https://www.waddensea-worldheritage.org/pssa-wadden-sea-operational-plans>.
[83]Netherlands Regulatory Framework (NeRF) – Maritime, *134(53) Designation of the Canary Islands as a particularly sensitive sea area* <https://puc.overheid.nl/nsi/doc/PUC_1529_14/1/>.
[84]Netherlands Regulatory Framework (NeRF) – Maritime, *135(53) Designation of the Galapagos archipelago as a particularly sensitive sea area* <https://puc.overheid.nl/nsi/doc/PUC_1530_14/1/>.
[85]OSPAR Convention (n 42): see OSPAR Commission, *OSPAR Convention*: <https://www.ospar.org/convention>.
[86]M Belchier, T Peatman and J Brown, 'The Biology, Ecology and Development of Fishery Management Advice for the Anomuran Crabs at South Georgia (CCAMLR Subarea 48.3)' (2012) 19 *CCAMLR Science*, 1-15.
[87]G Duhame and M Hautecoeur, 'Biomass, Abundance and Distribution of Fish in the Kerguelen Islands EEZ (CCAMLR Statistical Division 58.5.1)' (2009) 16 CCAMLR Science 1-32.
[88]CCAMLR, *Schedule of Conservation measures and resolutions for 2023/24* <https://cm.ccamlr.org/sites/default/files/2023-12/e-schedule2023-24_0.pdf>.
[89]UNEP, *South East Pacific* <https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/regional-seas-programmes/south-east>. Chile, Peru and Ecuador are members.
[90]UNEP, Northwest Pacific <https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/regional-seas-programmes/northwest>. Member states are the Democratic People's Republic of Korea; Japan; People's Republic of China; Republic of Korea; Russian Federation.
[91]UNEP, *NOWPAP Action Plan* <https://www.unep.org/nowpap/who-we-are/action-plan?_ga=2.109860101.1050151841.1713161802-1879681014.1713161802>.
[92]UNEP, 'West and Central Africa' < https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/regional-seas-programmes/west-and>.
[93]UNEP, 'East Asian Seas': <https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/regional-seas-programmes/east-asian>.
[94]COBSEA 2018. COBSEA Strategic Directions 2018–2022. Secretariat of the Coordinating Body on the Seas of East Asia (COBSEA) and United Nations Environment Programme, Bangkok.
[95]Paris Agreement art 2.
[96]Paris Agreement art 3 and 4 in particular.
[97]UNFCCC, NDC Register: < https://unfccc.int/NDCREG>.

analysis of these documents reveals that only one (that of Namibia) refers explicitly to kelp.[98] Nevertheless, many refer to nature-based solutions to climate change, including carbon sequestration and blue carbon, as well as the importance of conservation of marine and coastal ecosystems. Further research at the country level is needed to confirm whether kelp form part of the marine ecosystems encompassed in these plans. The lack of reference to kelp in the NDCs is clearly out of step with other marine ecosystems given that mangroves are mentioned in 55 NDCs, and seagrasses in 16 NDCs.[99] This may be because there is still scientific uncertainty around the role kelp forests play in cycling carbon, and they are not yet recognised as carbon sinks by the UNFCCC.[100]

As with other Convention bodies, the UNFCCC and Paris Agreement Secretariats have made scant reference to kelp. For example, the Climate Action Pathway, Oceans and Coastal Zones Action Table refers to nature-based solutions to climate change and specifically mentions coral reefs, seagrasses and mangroves, but not kelp.[101] This has not gone unnoticed and a group of NGOs submitted a recommendation document to the 2022 UNFCCC Ocean and Climate Change Dialogue highlighting that kelp were not included in initiatives and suggesting that the IPCC consider including kelp alongside other marine ecosystems, such as mangroves and seagrasses, and specifically in relation to blue carbon as and when scientific evidence emerges of their mitigation value.[102]

3.6 | The Convention on Biological Diversity's EBSAs, national reports and NBSAPs

The CBD is the first to focus specifically on ecosystems and to provide some area-based initiatives known to include kelp forests. As noted in Section 2, the CBD does not provide a listing mechanism that would allow sites with kelp forests to be identified and protected. However, as noted above, the work of the CBD on identifying EBSAs has potential to benefit kelp forests. Indeed, some of the CBD EBSA documentation makes reference to 'kelp beds' in the context of life in the ocean.[103] Of the individual identified EBSAs, three refer explicitly to kelp forests. For example, the Commander Islands Shelf and Slope (Russia),[104] Agulhas Bank Nursery Area (South Africa)[105] and North-eastern Barents–Kara Sea (Russia)[106] highlight kelp in the assessment against CBD EBSA criteria. In addition, Fehmarn Belt (Germany and Sweden), Danish Kattegat and Danish Skagerrak (Denmark), Murman Coast and Varanger Fjord (Russia), Coastal Waters of Chukotka (Russia), Southern Madagascar (part of the Mozambique Channel) (Madagascar) and Convergencia de la Deriva del Oeste (West Wind Drift Convergence) (Chile) mention kelp in their biological descriptions.[107] There is little doubt that kelp forests exist in other identified EBSAs in temperate waters, and this is another place where awareness raising could result in greater acknowledge of kelp forests.

The CBD requires member States to submit National Reports and NBSAPs. A search of these documents — all of which are publicly accessible via the CBD website — reveals that relevant references to kelp feature in seven national reports (Australia, Canada, China, Japan, Namibia, Norway and South Africa), but in only one NBSAP (Democratic People's Republic of Korea).[108] There is clearly potential to encourage greater recognition, conservation, management and restoration of kelp forests by Member States. Indeed, the CBD is also the only regime that specifically acknowledges that '… kelp forests support a greater variety and higher diversity of plants and animals than almost any other ocean community'.[109] In addition, several CBD initiatives refer explicitly to kelp including the ongoing Marine and Coastal Biodiversity Programme of Work[110] and the GBF include targets which could benefit kelp forests and contribute towards, justifying further attention upon them.

Three fundamental findings can be made from the above analysis: (1) only a relatively small number of listings or designations under international environmental law regimes specifically acknowledge the presence of kelp forests, (2) other international environmental law initiatives have not been fully utilised for the conservation and management of kelp forests and (3) kelp forests appear not to be recognised to the same extent as other marine ecosystems.

[98] *Namibia's Updated Nationally Determined Contribution* (2021) <https://unfccc.int/sites/default/files/NDC/2022-06/Namibia%27s%20Updated%20NDC_%20FINAL%2025%20July%202021.pdf>.

[99] UNEP 2023 (n 1) 92.

[100] CE Lovelock and CM Duarte, 'Dimensions of Blue Carbon and emerging perspectives' (2019) 15 Biology Letters 20180781.

[101] UN Climate Change, *Oceans and Coastal Zones - Climate Action Pathway*: <https://unfccc.int/sites/default/files/resource/OceansAndCoastalZones_ActionTable_2.1_uneditedversion.pdf>

[102] Joint Submission to the 2022 UNFCCC Ocean and Climate Change Dialogue Submitted by Conservation International on behalf of IUCN, Rare, The Nature Conservancy, WWF, Ocean Conservancy, Ocean & Climate Platform and the Marine Conservation Society, United Nations Framework Convention on Climate Change SBSTA 56 Ocean and Climate Change Dialogue June 2022 | Bonn, Germany <https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202203221420---UNFCCC-Ocean-Climate-Dialogue-2022-JointSubmission-FINAL.pdf>.

[103] Secretariat of the Convention on Biological Diversity (2014), *Ecologically or Biologically Significant Marine Areas (EBSAs): Special places in the world's oceans*, 7.

[104] CBD CHM, *Ecologically or Biologically Significant Areas (EBSAs) - Commander Islands Shelf and Slope*: <https://chm.cbd.int/database/record?documentID=204142&_gl=1*oq70jx*_ga*OTEyMTM1NDcxLjE3MTMxNjU1MTc.*_ga_7S1TPRE7F5*MTcxMzE2NTUxNi4xLjEuMTcxMzE2ODU1Mi4zOS4wLjA>.

[105] CBD CHM, *Ecologically or Biologically Significant Areas (EBSAs) - Agulhas Bank Nursery Area*: <https://chm.cbd.int/database/record?documentID=203986&_gl=1*14cinuh*_ga*OTEyMTM1NDcxLjE3MTMxNjU1MTc.*_ga_7S1TPRE7F5*MTcxMzE2NTUxNi4xLjEuMTcxMzE2ODU1Mi4zOS4wLjA>.

[106] CBD CHM, *Ecologically or Biologically Significant Areas (EBSAs) - North-eastern Barents–Kara Sea*: <https://chm.cbd.int/database/record?documentID=204095&_gl=1*113n852*_ga*OTEyMTM1NDcxLjE3MTMxNjU1MTc.*_ga_7S1TPRE7F5*MTcxMzE2NTUxNi4xLjEuMTcxMzE2ODU1Mi4zOS4wLjA>.

[107] See individual entries in CBD, Ecologically or Biologically Significant Marine Areas (EBSAs): <https://www.cbd.int/ebsa/ebsas>.

[108] Additional mentions are not relevant (e.g. noted as an invasive species, or referring to an unrelated species such as kelp fly/gull): CBD, 'National Reports and NBSAPs' <https://www.cbd.int/reports/search/?country=au>

[109] Secretariat of the Convention on Biological Diversity, *Marine Biodiversity - One Ocean, Many Worlds of Life* (CBD 2012).

[110] Secretariat of the CBD, *Marine and Coastal Biodiversity Programme of Work*: <www.cbd.int/doc/decisions/cop-07/cop-07-dec-05-en.pdf>.

4 | ANALYSIS OF FINDINGS

In this section, the three findings highlighted in Section 3 above, and demonstrated in Table 2, are explored in further detail. The purpose of this Section is to identify what greater role could be played by the individual treaties in kelp forest conservation and management, and to examine some of the barriers to greater recognition of kelp forests.

4.1 | Too few listings and designations refer to kelp forests

As the above discussion indicates, and as summarised in Table 2, only a limited number of kelp forests are formally protected through international regimes. In total, only 62 listed sites or designated areas are believed to contain kelp and all of these are under the Ramsar and/or World Heritage Conventions. This is not necessarily a problem in itself, as protection at the national level may be adequate, and the absence of an international listing is not fatal. Further research is needed to confirm whether national legal interventions are effective. Nevertheless, as indicated in Table 1, 30 nations have kelp forests in their waters and these States have all ratified the Ramsar Convention and World Heritage Convention, yet eight of these nations have no listed sites which contain kelp forests. Focusing on the existing listed areas under the Ramsar Convention and the WHC, the fact that kelp are present in those sites but not highlighted as a critical feature (i.e. as part of the nomination file or supporting documents, nor as a specific value of the site) is a further limitation As noted in Table 2, kelp are present in 62 listed sites, but of those designations, only 38 sites in 18 countries explicitly refer to kelp in their listing or nomination documents. If attention is not drawn to kelp, as a significant element of these sites, then it is likely their presence may not feature in implementation, operational and management plans. So, the explicit mention of kelp in the listing matters. It is likely that further research will demonstrate that there are gaps in listing and/or that data is needed about kelp forests in these waters.

Although, international law includes these two relevant regimes through which kelp forests could be listed, there are clearly some limitations of each. First, both regimes require a certain threshold to be met — international importance (Ramsar Convention) and OUV (WHC). Not all kelp forests will meet these criteria and yet may still provide critical ecosystem services at the national and regional level. Secondly, the Ramsar Convention does not apply in marine areas beyond 6 m depth, and kelp can occur to depths of 40 m or greater. Thirdly, the Contracting Parties are only required to list one wetland which may limit the incentive to list multiple kelp forests under this Convention. Fourthly, the Ramsar Convention focuses heavily on 'conservation, management and wise use', with no specific mention of kelp forests.[111] Specific guidance could be provided through focused reports, similar to those that have been prepared for other marine ecosystems, as noted above. Clearly, the Convention Secretariats could catalyse a focus on kelp as they have for coral reefs and mangroves. This would also serve to encourage Parties to amend their listings to include the presence of kelp forests in listed sites. It is acknowledged, however, that amendment of designation documents, and preparation of WHC nomination files in particular, is a complex and costly exercise. Here the Secretariats could champion updated OUV and WH listings through capacity building, financial and technical assistance.

Of the other regimes, kelp are explicitly mentioned in 10 CBD EBSAs in six States and in the NDCs of two States.[112] Furthermore, kelp are believed to exist in 11 IMO PSSAs in 10 States.[113] The NDCs set out nations' intentions with respect to mitigation and adaptation efforts in response to obligations under the Paris Agreement, but the measures included in the NDCs are not legally enforceable. The EBSAs and PSSAs include management measures, but they are not legally binding in and of themselves. Nonetheless, these three additional measures, respectively, demonstrate State awareness of kelp forests and their values, provide a means to prioritise conservation and management and prevent further damage to these ecosystems.

4.2 | Other international regimes could provide greater benefits for kelp forests

Beyond the Ramsar and WHC, there are other relevant regimes that could benefit kelp forests to a greater extent than at present. UNCLOS includes both general and specific obligations that could directly and indirectly benefit kelp. Article 192 binds parties to preserve the marine environment and provides a solid foundation for national action Furthermore, the obligations under UNCLOS. Other provisions could also be used indirectly to benefit kelp. For example, Article 61 referring to 'conservation of the living resources' where it is provided that parties must ensure that '… proper conservation and management measures [ensure] the maintenance of the living resources …' Although this is a provision relating to the EEZ, and kelp forests and other ecosystems such as coral reefs, seagrasses and mangroves are rarely found beyond the territorial sea, it could be argued that 'proper conservation and management measures' would require the preservation, enhancement and restoration of nursery grounds, habitat and food sources for the 'living resources' present in the EEZ. A healthy coastal ecosystem could therefore be a justifiable part of 'proper management' practices.

More directly applicable is the CBD which seeks to conserve biological diversity and ensure the sustainable use of its components by encouraging Member States to identify and monitor biodiversity, adopt conservation, management, recovery and rehabilitation measures for species and ecosystems, protect threatened species, promote environmentally sound and sustainable development and

[111] See Ramsar Convention Secretariat, *Ramsar Handbooks for the Wise Use of Wetlands* (4th edition, Ramsar Secretariat 2010) and *Principles and guidelines for wetland restoration*, Adopted by Resolution VIII.16 (2002) of the Ramsar Convention.

[112] See Table 2.

[113] ibid.

balance conservation and sustainable use. The entire Convention is relevant to kelp because it covers all natural ecosystems. More specifically, Article 6 encourages '… national strategies, plans or programmes for the conservation and sustainable use of biological diversity …'. In the context of global kelp decline, Article 7 emphasises the importance of identifying and monitoring ecosystems requiring urgent conservation measures as well as activities with potential to have adverse effects upon them. As noted above, Article 8 makes specific reference to the conservation and restoration of ecosystems in situ. Given these provisions and considering the high levels of biodiversity that are dependent on healthy kelp forests, the CBD is arguably the most appropriate framework to catalyse Member State actions to comprehensively conserve, manage and restore kelp forests.

Given that the CBD is also the only regime that has acknowledged the high value of kelp forests importance and that several CBD initiatives refer explicitly to kelp including the ongoing Marine and Coastal Biodiversity Programme of Work, there appears to be scope for scaling up activities that would benefit kelp forests and other marine ecosystems. Furthermore, as kelp forests currently feature in some National Reports and NBSAPs, there are opportunities to share knowledge and ideas for future domestic initiatives. As noted above, the CBD Strategic Plan for Biodiversity 2011–2020 including the Aichi Biodiversity Targets and the overall objectives remain relevant for kelp forests.[114] Notably, coral reefs are specifically mentioned in Target 10, in the context of climate change impacts, but other marine ecosystems such as kelp forests are not singled out. Although progress was made the goals were not achieved,[115] leading to the later adoption of the GBF with four goals for 2050 and 23 targets to be achieved by 2030.[116] The goals are quite general in nature and include maintaining, enhancing or restoring integrity and resilience of all ecosystems, and valuing ecosystem functions and services. The targets seek to reduce threats to biodiversity whilst also meeting human needs through sustainable use and benefit sharing. Notably, Target 2 sets a goal of restoring at least 30% of degraded areas including marine and coastal ecosystems and adds to the goal of conserving and managing at least 30% of terrestrial and aquatic areas by 2030 (Target 3). Although no specific mention is made of kelp, these goals and targets help to incentivise activities that may better recognise, protect and value kelp forests. Therefore, future CBD initiatives could focus more effectively on these ecosystems.

The UNFCCC and the Paris Agreement are arguably becoming of greater relevance for kelp forests. As defined in Article 1 of the UNFCCC the ocean is a 'reservoir' ' … component(s) of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored'. Therefore, kelp forests, aside from research showing their strong potential for direct carbon sequestration, participate in an indirect way to mitigate climate change by enhancing the buffer capacity of the world's most important 'reservoir'. Building on this approach, several other sections of the Convention are potentially triggered. Article 3.3, for example, endorses a precautionary approach in climate change mitigation strategies, by stating that the ' … lack of full scientific certainty should not be used as a reason for postponing […] measures'. Also, policies and measures undertaken should, among other things '… cover all relevant sources, sinks and reservoirs of greenhouse gases …'.[117] Yet, the most relevant part of the Convention in this scenario lies in Article 4.1. (d), which provides that parties shall:

> [p]romote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases … including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems.

Furthermore, Article 4.2. (a) adds that parties shall 'adopt national policies and take corresponding measures on the mitigation of climate change, by … protecting and enhancing its greenhouse gases sinks and reservoirs'.

The more recent Paris Agreement reinforces these commitments in Article 5.1 where it provides that '[p]arties should take action to conserve and enhance … sinks and reservoirs of greenhouse gases as referred in Article 4, paragraph 1 (d), of the Convention …' The sequestration potential of kelp forests, whilst presumably significant,[118] still has to be more precisely quantified. Therefore, currently, kelp forests do not fit neatly within climate change laws focusing on pre-established 'sinks'. Although the direct sequestration of carbon dioxide by kelp forests is the subject of ongoing research, the absorption of carbon through photosynthesis is an undisputable fact.[119] In this process, even if the kelp is later consumed and/or decays and releases a part of that carbon by respiration, it can still increase the buffer capacity of the ocean.[120] Therefore, it is arguable that kelp forests should already fall under both the UNFCCC and PA, in terms of being a GHG sink and reservoir. This could lead to their greater inclusion in GHG mitigation initiatives.

Although many NDCs refer to coastal and marine ecosystems, only one specifically mentions kelp and one refers to seaweed.[121] Kelp have received only limited attention in other climate-related publications, such as the Yearbook of Global Climate Action 2019, where their role as a fisheries habitat is noted as being at risk as ocean temperatures rise.[122] In addition to mitigation efforts, referred to above, kelp forests can contribute to adaptation in several ways such as coastal protection and wave energy absorption.[123] Therefore, there is

[114] Convention on Biological Diversity, 'Aichi Biodiversity Targets (CBD)' <www.cbd.int/sp/targets/>.
[115] ibid.
[116] *Kunming-Montreal Global Biodiversity Framework* (n 52).
[117] UNFCCC art 3.3.
[118] Krause-Jensen and Duarte (n 7); and Filbee-Dexter and Wernberg (n 9).
[119] Pessarrodona et al (n 10).
[120] HK Hirsh et al, 'Drivers of Biogeochemical Variability in a Central California Kelp Forest: Implications for Local Amelioration of Ocean Acidification' (2020) 125(11) JGR Oceans e2020JC016320; I Santos et al 'The renaissance of Odum's outwelling hypothesis in 'Blue Carbon' science' (2021) 255 Estuarine, Coastal and Shelf Science 107361.
[121] See Table 2.
[122] UN Climate Change Secretariat, *Yearbook of Global Climate Action 2019* (UNCCS, 2019).
[123] RL Morris et al, 'Kelp beds as coastal protection: Wave attenuation of Ecklonia radiata in a shallow coastal bay' (2020) 125 Annals of Botany 235; and RL Morris et al, 'From grey to green: Efficacy of eco-engineering solutions for nature-based coastal defence' (2018) 24(5) Global Change Biology 1827.

much greater potential for kelp forests to feature in NDCs in the future and the international community can play a role in raising awareness, and building technical capacity, for States to do so.

None of the RSP conventions, protocols, action plans or projects focuses on kelp. Nevertheless, there are several initiatives that could be utilised as a model for future kelp forest activities. For example, the West and Central African RSP includes the Calabar Protocol on Sustainable Mangrove Management,[124] and the East Asia Seas RSP has developed a Regional Action Plan for the Conservation of Mangroves of the Southeast Pacific.[125]

The majority of measures explored above take an area-based approach, which may not benefit kelp.[126] Treaties such as Convention on the International Trade in Endangered Species (CITES) and the Convention on Migratory Species (CMS) focus on species themselves. No kelp species are globally listed under CITES, presumably because they are not yet endangered enough, or traded at international levels, which require such a listing. This is unlikely to change as there are many more animal and plant species whose conservation status is at greater risk. No doubt kelp could benefit from CMS listings because range States are required to enter into agreements for migratory species, some of which utilise kelp forests as habitat. However, the protections that might be afforded to kelp forests under this regime are tangential only. This serves to highlight the issue that until a species is endangered, or unless it is of global significance, it will not attract international protections.

Recent developments, such as the adoption of the BBNJ Agreement and the current negotiations for a plastics treaty,[127] could also benefit kelp. No kelp forests have been found in areas beyond national jurisdiction, and therefore, there are no identified sites that could be nominated for listing. The plastics treaty negotiations are still too nascent to draw conclusions about their value for kelp ecosystems; however, any efforts to reduce pollution, from land-based sources and plastics, is likely to be of some benefit to kelp forests in coastal waters.

As noted above, kelp forest conservation, utilisation and restoration can contribute to the achievement of several SDGs. Furthermore, kelp forests could benefit from initiatives under the auspices of the SDGs. For example, SDG 14 focuses on Life Below Water and includes several specific goals that will benefit kelp forests:

1. 14.1 — reducing marine pollution
2. 14.2 — sustainably manage and protect marine and coastal ecosystems
3. 14.5 — conserve at least 10 per cent of coastal and marine areas
4. 14.c — enhance the conservation and sustainable use of oceans and their resources by implementing international law

Kelp forests may also be able to contribute more fully to the achievement of other targets under SDG14:

1. 14.3 — minimising and addressing the impacts of ocean acidification
2. 14.7 — increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources

It is clear, however, that kelp forests can contribute to, or benefit from, the majority of the SDGs.[128] Most relevant are:

1. 2.4 — ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.
2. 8.4 — Improve progressively, through 2030, global resource efficiency and production and endeavour to decouple economic growth from environmental degradation [...]
3. 12.2 — by 2030, achieve the sustainable management and efficient use of natural resources.
4. 13.1 — strengthen resilience and adaptive capacity to climate-related hazards and natural disasters

Given the strong global support for the SDGs, including the formation of the UN High-level Political Forum on Sustainable Development, focusing on how kelp contribute to their achievement could be an effective way to garner support for kelp forest conservation.

4.3 | Relative invisibility of kelp forests compared to other marine ecosystems

A further finding is that kelp forests have not received the same global attention as other marine ecosystems, demonstrated by focused instruments under RSPs and CBD initiatives. This confirms the finding in the UNEP Report, 'Into the Blue', that fewer NDCs mention kelp than mangroves, seagrasses, tidal and salt marshes.[129] Coral reefs clearly attract more attention and international environmental law interventions. This could, perhaps, be explained as they are 'charismatic', tropical environments that feature strongly in tourism and garner considerable public support. Yet, kelp forests are also falling behind both mangroves and seagrasses as well. Not only are the current listings of relevance, but so too is the trajectory for future listings. Research has shown that relatively little attention has been paid to

[124]UNEP, 'West and Central Africa' <https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/regional-seas-programmes/west-and>.
[125]UNEP, 'South East Pacific' <https://www.unep.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/regional-seas-programmes/south-east>. Chile, Peru and Ecuador are members.
[126]K Filbee-Dexter et al, 'MPA's can be useful but are not a silver bullet for kelp conservation', (2024) 60(2) Journal of Phycology 203-213.
[127]The United Nations Environment Assembly (UNEA-5.2) adopted a resolution committing to creating a legally binding treaty by 2024: UNEP, *UNEA Resolution 5/14 entitled "End plastic pollution: Towards an international legally binding instrument"* UNEP/PP/OEWG/1/INF/1 (10 May 2022).
[128]Feehan et al (n 9).
[129]UNEP 2023 (n 1) 92.

kelp forests by international environmental regimes and inter-governmental institutions.[130] If support is to be catalysed for kelp forest conservation, management and restoration then awareness must be raised. Many of the initiatives suggested above would achieve this goal, but they also depend, in part, upon scientific data and communication of that science. International law and policy-makers must now respond to the growing scientific literature and calls by scientists to upscale kelp forest conservation and restoration efforts.[131]

International institutions, beyond those associated with key international environmental law treaties, have significant roles to play in catalysing and supporting ecosystem-based programmes of work and activities that might benefit kelp forests as they have done for other ecosystems. For example, as an advisory and regulatory body, the Food and Agriculture Organisation (FAO) could consider healthy kelp ecosystems in the broader context of sustainable seaweed farming as a major policy initiative. This has already been referred to, but not yet realised, in the FAO 2019 report 'The State of the World's Aquatic Genetic Resources for Food and Agriculture.[132] The FAO has championed the development of resources for other marine and coastal ecosystems, but not for kelp forests, through the World Atlas of Mangroves.[133] Furthermore, the FAO has supported law and policy analyses focused on mangroves in different nations,[134] as have UNEP and GEF.[135] Similar initiatives could focus on law and policy for kelp forests. Finally, 'Into the Blue' also highlights the relevance of kelp forests for fisheries and this could provide an impetus for the FAO. UNEP has taken the lead by replicating its global analysis for seagrasses for kelp forests. It is to be hoped that the publication of 'Into the Blue' will raise global awareness and activities in response.

5 | PROPOSALS FOR THE FUTURE

The above analysis demonstrates that there are a number of ways in which existing international law could provide greater benefits for kelp forests. Finding ways to expand the use of existing international environmental law is therefore critical. In exploring recommendations for the future, and to stimulate further research, three proposals are examined in turn below.

5.1 | A global instrument for marine ecosystems

Section 2 of this paper highlighted that there is no comprehensive international law regime for marine ecosystems and Sections 3 and 4 demonstrate that piecemeal approaches are failing kelp forests and probably other marine ecosystems as well. Our first proposal, therefore, is for the development of a comprehensive international law instrument.

It is tempting to suggest that a legally binding instrument should be developed, but this is not likely to draw much international support. What may be more feasible is a non-binding international instrument that could be applied to marine ecosystems to focus global attention and serve as a catalyst for further action. The instrument could play a role in integrating existing initiatives by building upon, for example, the CBD EBSAs and approach of combining conservation and sustainable use, as well as drawing upon some of the features of the other treaties such as the UNCLOS obligation to protect and preserve the marine environment and concept of vulnerable marine ecosystems and RSP focus on LMEs. A possible model for such a soft law instrument is the Statement of Forest Principles which refers to both the ecological and economic value of forests, outlines roles for both the international community and governments, promotes inclusive and holistic approaches and specifically refers to the role of law and policy.[136] Such an approach may be particularly appropriate given that mangroves and kelp are harvested in many parts of the world, and interest in seaweed farming and aquaculture is growing. Appropriate conservation and management of these and other marine ecosystems (such as seagrass meadows) has the potential to preserve and enhance biodiversity, has meaningful mitigation impacts on greenhouse gases (GHG) and climate change and be a sustainable source of tradeable commodities. Restoration could again be a strong feature. An external body could be tasked with building knowledge of marine ecosystems (and kelp forests in particular) supporting States to assess and monitor kelp forests and to facilitate best practice. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is a possible institution to do this and could play a similar role to that of the IPCC in the international climate change regime.[137] IPBES could also act as a centralised organisation for knowledge sharing and technology transfer. As a science-driven body, it could also release a state of the world's marine and coastal forests report every 4 years — akin to FAO's 'State of the World Fisheries and Aquaculture' — highlighting trends, improvements and concerns along with making recommendations.

5.2 | A common work programme supported by a memorandum of understanding (MOU)

Section 3 above demonstrates that there are multiple initiatives across different international law regimes through which kelp forests receive

[130]Valckenaere et al (n 15).
[131]Feehan et al (n 9).
[132]FAO, *The State of the World's Aquatic Genetic Resources for Food and Agriculture* (FAO Commission on Genetic Resources for Food and Agriculture assessments 2019).
[133]M Spalding, M Kainuma, and L Collins, *World Atlas of Mangroves* (Routledge 2010).
[134]N Beresnev, T Phung, and J Broadhead, *Mangrove-related policy and institutional frameworks in Pakistan, Thailand and Viet Nam* (FAO/IUCN 2016).
[135]S Hawkins et al, *Roots In The Water: Legal Frameworks for Mangrove PES in Vietnam* (Katoomba Group/Forest Trends 2010).
[136]UNGA, Report of the UN Conference on Environment and Development, *Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests* (Annex II) A/CONF.151/26 (12 August 1992).
[137]IPBES is a non-UN inter-governmental organisation with 140 member States, which works to understand the importance of biodiversity and the causes of biodiversity loss, as well as to measure the contribution of nature to people and human effects and dependence on biodiversity. Relevantly, one key objective is to support policy including through scenarios and modelling of biodiversity and ecosystem functions and services: IPBES, *Work Programme*: <https://www.ipbes.net/>.

some protection, conservation and management. Section 4 explores the ways in which individual treaties could provide greater benefit to kelp forests. The UNEP Report called for existing global frameworks to be used more effectively,[138] and our second proposal goes one step further by suggestions a common work programme to provide more holistic responses.

Any new instrument, whether soft law or not, would take considerable resources to develop and would rely upon global support for enhanced conservation and management of marine and coastal ecosystems and/or kelp forests. As an initial step, and in order to focus attention and actions, a common work programme supported by an MOU between the Ramsar Convention, WHC, CBD and UNFCCC/Paris Agreement could provide multiple benefits. Other potential stakeholders could include UNEP and the RSPs and the IMO with regard to PSSAs. UNCLOS provides a foundation for such a collaborative approach given member State obligations to cooperate, on a global or regional basis, for the protection and preservation of the marine environment.[139] The advantage of a shared programme of work and/or platform for conservation, management and restoration, is that it would serve to focus global attention (lacking at the moment), safeguard against duplication of effort through increased collaborative activities and provide a focal point for sharing emerging scientific study (for example on conservation and restoration, aquaculture, nature-based solutions to climate change).

A common work programme model has been used before, but not across such a wide variety of treaty regimes. For example, the Rio Conventions (CBD, UNFCCC and UN Convention to Combat Desertification) formed a Joint Liaison Group in 2001 which has led to some synergistic activities including agreed Terms of Reference and Modus Operandi and support for a Project Preparation Facility to increase financing for large-scale, transformative projects which integrate action on land degradation, biodiversity loss, and global warming.[140] Another relevant example is the 1999 MOU Between the Ramsar Convention and WHC which is particularly beneficial for dual-designated sites and has led to the publication of a report drawing on a selection of case study areas.[141] Beyond existing examples, some academic scholarship has focused on regime interaction in different contexts.[142]

5.3 | A collaborative alliance

We have highlighted in Section 4 that there are no global partnerships for the conservation and management of kelp forests, unlike other marine ecosystems such as mangroves. Our third proposal is to establish such an initiative for kelp forests. This proposal is supported by the UNEP Report 'Into the Blue' which recommended supporting the development of a global alliance among nations whose waters contained kelp.[143] Arguably, exploring only interventions that involve State-based actors and institutions is too limited in scope. Therefore, a collaborative alliance that harnesses all stakeholders (public/governmental, private, academic/research and not-for-profit sectors) with interests and expertise in kelp forests would be more beneficial. Such an alliance could also champion the conservation, management and restoration of kelp forests in international law such as advocating for high value kelp forests to be included as part of the outstanding universal values of World Heritage sites and explicitly form part of the justification for Ramsar Convention listings.

Furthermore, the alliance could catalyse the recognition of kelp forests in existing EBSAs, PSSAs and LMEs, as well as incentivising domestic implementation of kelp forest conservation and management. A focused CBD initiative could facilitate inclusion in NBSAPs and National Reports as the values of, and ecological services provided by, kelp forests become more widely known. Existing MPAs could be expanded to recognise kelp forests and to meet the CBD GBF goals and targets. However, it is perhaps within the framework of the Paris Agreement and the NDCs that there is the greatest potential to recognise the multiple services and values provided by kelp forests in the context of blue carbon and nature-based solutions to climate change. Again, this is an area where the international community could raise awareness and build capacity by providing training and education programmes as well as resources. Some work has been done to analyse where nature-based solutions feature in NDCs[144], and now, action plans and capacity-building options are needed.

Although ambitious, the establishment of a multi-stakeholder, multi-level alliance has several advantages including its flexibility and potential to respond swiftly to emerging science and evolving issues. It might also be the most achievable because it has been done for other species. Possible models include the Mangrove Alliance[145] and the global seagrass observing network Seagrass-Watch.[146] Indeed, initial steps have already been taken in this direction with the establishment of the Kelp Forest Alliance[147] and the Green Gravel Action Group.[148]

6 | CONCLUSION

Kelp forests have provided crucial ecosystem functions and services for millennia, and human communities continue to rely on them in

[138]UNEP 2023 (n 1) 7.
[139]UNCLOS art 197. See also Kojima (n 38).
[140]Convention on Biological Diversity, Cooperation and Partnerships: <https://www.cbd.int/cooperation/liaison.shtml>.
[141]UNESCO, *World Heritage and Ramsar Convention on Wetlands* <https://whc.unesco.org/en/ramsar/>; and R McInnes, M K Ali and D Pritchard, *Ramsar and World Heritage Conventions: Converging Towards Success* (Ramsar Convention Secretariat 2017).
[142]See for example M Young, 'Climate Change Law and Regime Interaction' (2011) 5 (2) Carbon & Climate Law Review 147; and M Young (ed) *Regime Interaction in International Law: Facing fragmentation* (2012, CUP).
[143]UNEP 2023 (n 1) 7.
[144]N Seddon et al, *Nature-based Solutions in Nationally Determined Contributions: Synthesis and Recommendations for Enhancing Climate Ambition and Action by 2020* (IUCN and University of Oxford 2019); and M Lecerf et al, *Coastal and Marine Ecosystems as Nature-based Solutions in New or Updated Nationally Determined Contributions*, (Ocean & Climate Platform,Conservation International, IUCN, GIZ, Rare, The Nature Conservancy and WWF 2021).
[145]Mangrove Alliance: <https://www.mangrovealliance.org/>.
[146]Seagrass Watch: <https://www.seagrasswatch.org/>.
[147]Kelp Forest Alliance: <https://kelpforestalliance.com/>.
[148]Green Gravel: <https://www.greengravel.org/>.

myriad ways. As kelp forests come increasingly under threat, it is vital that efficient and effective interventions are undertaken to conserve, sustainably manage and restore these marine ecosystems. International law can play a critical role in advancing the conservation and management of kelp forests by providing a framework of common obligations, supported by incentives and targets, as well as capacity-building mechanisms for national implementation and fora for awareness raising. This article has highlighted the international environmental laws that could be utilised to benefit kelp forests, as well as where they have been so used. The analysis demonstrates that global regimes have been under-utilised, particularly vis-à-vis other marine ecosystems such as coral reefs and mangrove forests. Further research is needed to fully explore the reasons for this finding and therefore whether effort should be put into new scientific research, greater awareness raising and/or focused legal action. In relation to the role of law, whether through the greater utilisation of existing international law or via the development of new initiatives, the global community must take decisive action now — before it is too late.

DATA AVAILABILITY STATEMENT

Data on the results of searches or treaty texts, listings and websites are available on request from the authors. However, for the most part, no new data were generated.

ORCID

Erika Techera https://orcid.org/0000-0001-8283-2967

AUTHOR BIOGRAPHIES

Erika Techera is a professor of Law at The University of Western Australia. Her principal areas of research are international and comparative environmental law, with a focus on oceans governance and the Indo-Pacific region. Much of her research explores marine environmental law in small island developing states. Erika has published over 100 peer reviewed articles, chapters and papers, is a co-editor of the *Routledge Handbook of International Environmental Law* (2021) and a co-author of *The Unruly Ocean: Law and Justice in the World's Oceans Seas and Shorelines* (Routledge 2024).

Jurgen Valckenaere is a PhD candidate at the UWA Oceans Institute and the University of Western Australia. His research focuses on the concept of future-proofing in the coastal environment and particularly kelp forests and temperate reefs. This includes investigating ways to enhance restoration methods, drivers of success and assessing frameworks to future-proof coastal ecosystems.

Karen Filbee-Dexter is an ARC Future Fellow at the University of Western Australia and a researcher at the Institute of Marine Research in Norway. Her research focuses on the ecological impacts of climate change on the functioning of kelp forests. This includes understanding drivers and patterns of long-term change in kelp ecosystems, estimating seaweed carbon cycling and storage potential, documenting climate-driven expansion of kelp forests in some Arctic regions and developing new methods and funding mechanisms for kelp restoration. Dr. Filbee-Dexter has a PhD in kelp forest ecology from Dalhousie University, Canada, and has worked extensively in Norway, Canada and Australia.

Thomas Wernberg is an ARC Laureate Fellow and a professor of Marine Botany who studies seaweed forests and climate change. He heads the Wernberg Lab (wernberglab.org), at the University of Western Australia, and he is a senior scientist at the Norwegian Institute of Marine Science. Thomas is an editor-in-chief for the journal *Aquatic Botany*; he is a Clarivate highly cited scientist and ranked among the top 200 most influential climate scientists in the world by Reuters.

How to cite this article: Techera E, Valckenaere J, Filbee-Dexter K, Wernberg T. Successful conservation and management of kelp forests requires more ambitious use of international law. *RECIEL*. 2024;1-18. doi:10.1111/reel.12569