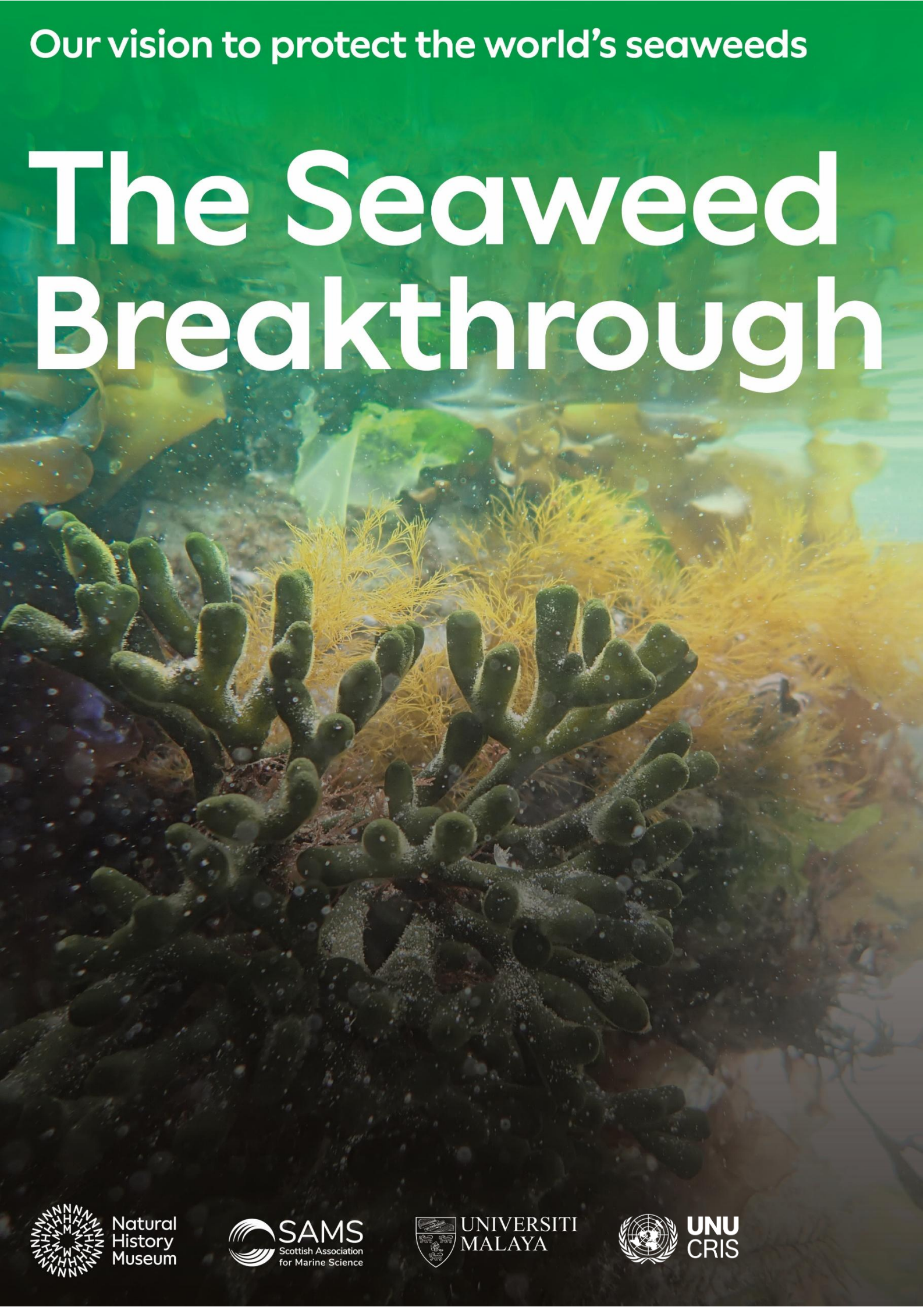
Our vision to protect the world's seaweeds

The Seaweed Breakthrough



Natural History Museum

SAMS Scottish Association for Marine Science

UNIVERSITI MALAYA

UNU CRIS

The Seaweed Breakthrough aims to catalyse global action to conserve, restore, and sustainably manage seaweed ecosystems and secure the livelihoods of many millions of people by 2030. This will be achieved through the following ambitious targets.

Goal 1. Halt loss: Reduce loss of seaweed habitats driven by direct and indirect human actions by 70% from a known baseline by 2030 and to 0% by 2040.

Goal 2. Protect and conserve: Increase long-term protection of seaweed habitats by 30% by 2030. Achieve 100% protection by 2040.

Goal 3. Restore seaweed ecosystems: Restore seaweed habitats, where possible, to cover areas of loss by 30% by 2030, 50% by 2040 and 100% by 2050.

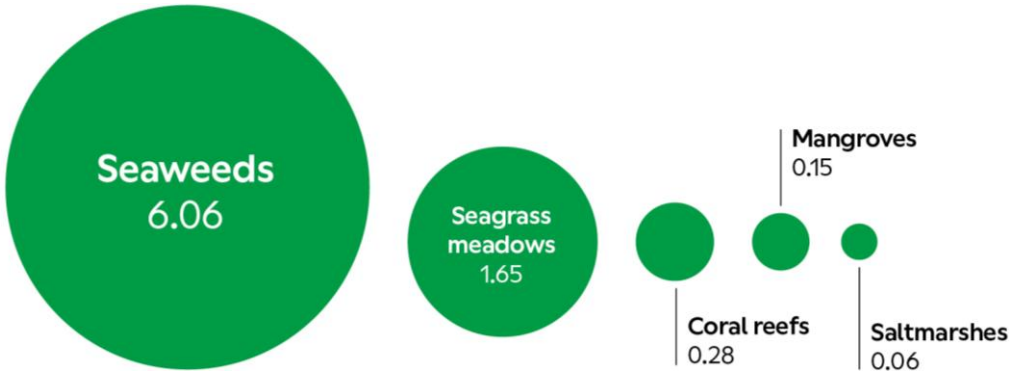
Goal 4. Secure resilient and equitable livelihoods: Secure resilient, equitable and sustainable livelihoods for many millions of seaweed-related farmers and other stakeholders globally by 2030.

Goal 5. Secure sustainable financing for seaweed protection and restoration: Secure investments of at least $17.5 billion USD ($4.4 billion USD year^{-1}) by 2030 to conserve, protect and restore seaweed habitats.

The importance of seaweeds

Protection for wild seaweeds and their habitats is critical. Seaweeds - red, green and brown - are integral to global marine ecosystem functioning, providing an extensive range of ecosystem services[1]. They support an enormous variety of organisms and are the feeding and breeding grounds of many of the world's commercial fisheries. Wild seaweeds hold the genetic resources that are the foundation of the seaweed industry[2], and provide the resources that sustain global fisheries. They therefore help to ensure food security and support the livelihoods of over 6 million people in coastal communities worldwide[3].

Estimated global coverage of seaweeds (million km^2) in relation to major marine vegetated habitats:



Adapted from Corrigan et al. 2025, DOI: doi.org/10.5519/4ln9oqk7

Globally, seaweed habitats rival, and may surpass, the area of the Amazon rainforest.

Seaweeds form habitats. From extensive areas of rhodolith beds which are red, free-living calcified seaweeds, to the architectural giant kelp forests, they cover the largest estimated area of all the interconnected vegetated marine habitats, comprising seagrasses, coral reef, mangroves and saltmarshes[1].

Seaweeds are threatened. Seaweed habitats are threatened by extraordinary human-induced threats, including global climate change, marine heatwaves, pollution and invasive non-native species. Despite their importance, seaweeds and the habitats they create are barely mentioned in policy, conservation and environmental management documents. Most available policies do not explicitly encompass foundational species, such as seaweeds, in the marine environment. Protection remains fragmented, with major data gaps limiting effective planning. While some coastal communities are resilient, many face climate risks, depleted marine resources, insecure livelihoods and limited decision-making power. Persistent underinvestment creates a significant financial gap, hindering the scale-up of protection and restoration.

The State of the World's Seaweeds is the first report to bring together information on seaweed diversity, habitats, ecosystem services, key threats, the global seaweed industry, the Sustainable Development Goals (SDGs), and conservation and restoration initiatives[1]. With only an estimated 50% of seaweed species are known, multiple sources of evidence show that species and habitats are declining or disappearing at an alarming rate even before they can be discovered or described. Yet, protection of seaweeds remains inadequate or non-existent. This document provides the evidence base to lead a Seaweed Breakthrough initiative, aimed to protect seaweeds through the United Nations Framework Convention on Climate Change (UNFCCC) 2030 Breakthrough Agenda. ***FIND OUT MORE:*** State of the world's seaweeds report doi.org/10.5519/4ln9oqk7

The UNFCCC Breakthrough Agenda. A Breakthrough is a science-based initiative to implement large-scale restoration and protection of habitats using measurable indicators and achievable goals. The indicators and goals are set for governments and NGOs, to collectively restore and protect habitats at a scale that is large enough to ensure the survival of these ecosystems. It provides a framework for all stakeholders to work together to safeguard the future of global seaweed habitats and the many millions of livelihoods that depend on them globally. All global economic and environment sectors are organised into Breakthroughs to drive a resilient, zero carbon future by 2030.

Developing the Seaweed Breakthrough

The Seaweed Breakthrough initiative came about because of the urgent need to protect seaweeds. It aims to mobilise global action to accelerate seaweed conservation, grounded in evidence with measurable indicators and achievable goals. It provides coastal nations with a practical pathway to join a global movement for securing their share of the blue economy i.e., protecting critical marine resources that support populations. The Seaweed Breakthrough is fully aligned with the Kunming-Montreal Global Biodiversity Framework (GBF), the Paris Agreement, the UN Decade on Ecosystem Restoration and Ocean Science and related UN Breakthrough initiatives. It creates an opportunity for countries to safeguard natural capital while advancing sustainable blue economy strategies, supported by international collaboration and improved market access.

The Seaweed Breakthrough targets were reached by a panel of 73 experts from all continents who came together to formulate ambitious yet realistic targets to drive change. How the targets were calculated is shown in the Appendix.

Developing Key Performance Indicators (KPIs). For each goal, a set of representative indicators have been proposed by the expert panel. Additional examples of indicators have also been included for each target which align with the Kunming-Montreal Global Biodiversity Framework (GBF). KPIs for the Seaweed Breakthrough are under development based on both expert knowledge and GBF indicators, and will include wider stakeholder engagement.

Guiding Principles

For all parties who commit to endorsing the Seaweed Breakthrough, we ask that their initiatives align with the following ten Guiding Principles, which are aimed at protecting seaweeds and their wider habitats in an ethical, fair and equitable way. The Principles provide a Code of Conduct for all parties, including civil society organisations, governments, Indigenous Peoples, local communities and the private sector.

Safeguarding nature and ecosystem function	All actions contributing to the Seaweed Breakthrough must align with protecting seaweeds and their habitats.
Employing science-based best practices in decision making	The most up-to-date scientific knowledge base and evidence-based understanding, including local knowledge and Indigenous knowledge, must be used to inform principles and practices for the Seaweed Breakthrough.
Inclusion, equity and justice	All conservation, restoration, monitoring and finance activities relating to the Seaweed Breakthrough must be undertaken with sensitive and explicit fair, free, prior and informed consent. It must support, engagement, social inclusion, prioritisation of human and environmental rights, gender equality, and leadership of local communities, including Indigenous Peoples and marginalised communities, who depend upon or live alongside seaweed habitats. All actions must also ensure a just and equitable access to and clear benefit from efforts to conserve, protect and restore seaweeds for local communities, including the data and information generated from any such actions.
Empowerment and capacity building	All activities must include some form of capacity building as necessary to empower through the development and strengthening of skills, abilities and resources of organisations and communities who rely on seaweeds, taking into account gender and social equity.
Transparency and accountability	All activities related to the Seaweed Breakthrough must be conducted transparently and in an accountable manner.
Monitoring, Compliance, and Enforcement	All impacts (positive and negative) related to the activities of the Seaweed Breakthrough must be tracked at local, regional and global levels against Global Biodiversity Framework indicators to show progress on the delivery, review performance and highlight the legacy of the Breakthrough targets.
Policy Coherence	All actions, as appropriate, related to the Seaweed Breakthrough must work to harmonise policies across various sectors and local legal frameworks to create a unified approach that supports and promotes the effective management of both the conservation of seaweed ecosystems and the livelihoods of communities dependent on these resources.
Design for sustainability, resilience and adaptability	All activities contributing to the Seaweed Breakthrough should be designed to be sustainable, resilient and adaptable, using climate-smart approaches beyond 2030, to ensure flexibility accounting for the climate crisis.
Sustainable financing	All stakeholders must ensure that financing for the Seaweed Breakthrough is ethical and includes diverse sources of funding through sustainable, long-term financing and investment methods; consideration of natural capital accounting and development of nature-positive economies should be included.
A platform for innovation	All activities relating to the Seaweed Breakthrough should enable stakeholders to pioneer new innovative solutions, whenever possible.

Goal 1. Halt Loss

Target: Reduce loss of seaweed habitats from direct and indirect human actions by 70% from an established baseline by 2030 and to 0% loss by 2040.

Action: Prevent loss and degradation of seaweed habitats by addressing direct and indirect drivers of loss, including over-harvesting, coastal development and pollution. Co-develop policies that halt habitat decline and guide community-based incentives for local stewardship. Scale up proven approaches to deliver targeted interventions addressing interconnected land–sea pressures through integrated seascape management. Loss must be assessed across multiple dimensions including extent (area covered), species diversity, genetic diversity within and between populations (connectivity) and ecosystem services (e.g., fisheries support).

Why act now? Some seaweeds are undergoing catastrophic declines e.g., kelps in Australia where in some regions, > 95% of the forest canopy has been lost. Healthy seaweed habitats and their associated ecosystem functions underpin coastal resilience, fisheries productivity and livelihoods, and play a critical role in marine carbon and nutrient cycles. Acting now to halt loss will prevent further habitat degradation and reduce the risk of ecosystem collapse, avoiding significantly higher future restoration costs.

Delivering actions:

1. **Global assessments and monitoring.** Conduct a global assessment of seaweed species, their habitats and ecosystem extent and status to establish baselines for monitoring change. Develop open, standardised monitoring systems (e.g., remote sensing, modelling, citizen science), and enable data sharing. Initiate working groups to accelerate closure of data gaps and build in-country capacity for assessments. Link mapping and partnerships with parallel UN Breakthrough conservation programmes to share resources. Where possible, apply IUCN Global Ecosystem Typology (GET), Green Status of Species and Red List (shared activity with Goal 2) to support comparable conservation strategies. Build in-country seaweed taxonomic capacity. Map drivers of loss to understand regional dynamics and to guide approaches.
2. **Stakeholder engagement.** Facilitate co-design of policies with governments, civil society, local communities and the private sector to mitigate threats to wild and farmed seaweed habitats. Support progress through advocacy and awareness campaigns, highlighting the ecological and economic importance of seaweeds. Ensure viable sustainable practices by complementing threat reduction with strong incentives, including community-driven credit innovation (Goals 2, 4 & 5), sustainable market opportunities (Goal 4), and access to sustainable finance (Goal 5).

Representative indicators:

- Mapped defined habitat area (km^2) within targeted high priority protected or managed zones (e.g., within MPAs or co-managed local areas).
- Ecological condition: A measurable share (e.g., 70%) of remaining seaweed beds maintained in good condition.
- Percentage of national environmental policies addressing drivers of loss.
  Number/proportion of priority communities/MPAs implementing standardized monitoring and active management plans (process indicator).
- Red list Index (GBF).
- Index of coastal eutrophication potential (GBF).

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Goal 2. Protect and conserve

Target: Increase long-term protection of seaweed habitats by 30% by 2030. Achieve 100% protection by 2040.

Actions: Protected areas offer solutions. Effective, co-designed and co-managed area-based protections ensure key representative, biodiverse seaweed habitats remain intact, functional and interconnected. Such measures can safeguard ecosystem services, reduce food security risks and strengthen climate resilience.

By 2030, ensure that an additional 30% of priority seaweed habitats are within effective, equitable, and well-connected networks of Marine Protected Areas (MPAs) and Other Effective Area-Based Conservation Measures (OECMs), increasing coverage annually toward full protection by 2040, with at least 10% under highly protected status.

Why protect seaweed habitats? Alarmingly, seaweed habitats and associated ecosystems are highly under-represented in marine protection globally. Where protection exists (e.g. rhodolith beds and kelp forests), it is often incidental (e.g., coral reef MPAs), leaving key biodiversity areas (KBAs) exposed to unsustainable harvest, destructive fishing, and coastal pollution.

Delivering actions: Interventions will focus on strengthening area-based protection measures to safeguard ecological processes through science innovation and improved policy, governance and community engagement:

1. **Identify priority areas.** Establish regional baselines for the presence and coverage of priority seaweed taxa and habitats, working towards a global stock assessment (Goal 1).
2. **Capacity building.** Build regional and national capacity through cooperative agreements to designate or upgrade MPAs, OECMs, and marine spatial plans; aligned with 30x30 targets.
3. **Stakeholder engagement.** Strengthen protection effectiveness through community co-designed rules addressing wild harvesting, destructive fishing, pollution, and biosecurity, supported by education and awareness raising and support for alternative and supplementary sustainable livelihoods, including restorative seaweed culture (shared with Goal 1).
4. **Integrate seaweeds into policies and frameworks.** Facilitate the integration of seaweeds into national and global policy and conservation frameworks. This can be achieved through cooperative agreements, ensuring alignment with processes such as Marine Spatial Plans (MSPs), Nationally Determined Contributions (NDC), National Biodiversity Strategic Action Plans (NBSAPs), National Adaptation Plans (NAPs) and coastal regulations, and promoting policy coherence and a realistic pathway to meet pledged targets.
5. **Appropriate finance.** Explore local, community-driven finance models to support conservation (Goal 5).
6. **Seaweed gene banking.** Seaweed material is deposited in culture collections to conserve endangered species.

Representative indicators:

- Percentage area of mapped seaweed habitat under formal protection (MPA/OECM) in prioritized ecoregions.
- Level of inclusion of seaweed species in international, national and regional biodiversity frameworks by 2030.
- Increase in national/regional gene banks and number of species deposited.
- Protected Area Management Effectiveness (PAME) (GBF).

Goal 3. Restore seaweed ecosystems

Target: Restore seaweed habitats, where possible, to cover areas of loss by 30% by 2030, 50% by 2040 and 100% by 2050.

Why restore. Restoration is a proactive, nature-based solution to rebuild ecosystem function, halt and reverse biodiversity loss, and in turn secure critical provisioning services that underpin coastal and climate resilience. Large-scale, responsible and sustainable, scientifically robust community-led projects, paired with threat reduction and protection, will support KM-GBF Target 2 restoring 30% of degraded ecosystems by 2030, and advances the UN Decade on Ecosystem Restoration.

Assessment and intervention. Restoring degraded priority seaweed habitats requires a phased, ecosystem-based approach. It begins with assessment and planning to understand local biogeography and ecosystem function. Removing drivers of loss (Goal 1) and securing area-based protection (Goal 2) creates the conditions for recovery. Where natural regeneration cannot meet ecological objectives, active restoration (Goal 3) is applied. Global best practices should be applied and continuously updated to ensure restoration methods are feasible, genotypically and ecologically sound, and deliver long-term success.

Developing actions. Strategic investment will accelerate restoration by closing technical gaps, building best practices, and driving down costs at increased scale. This creates a practical pathway to strengthen seaweed ecosystem resilience and support climate adaptation at scale.

Active restoration (reseeding/out planting and assisted recovery) should be deployed strategically, guided by ecological evaluation and genetic safeguards. In-situ and ex-situ gene banking (Goal 2) will conserve genetic diversity and provide resources to support restoration success. Well-funded, community-led restoration has the potential to deliver large-scale climate resilience and inspire deep community engagement in ocean stewardship.

Representative indicators :

- The number of rehabilitated seaweed habitats with the corresponding amount as a percentage of vegetation cover.
- The percentage threats/drivers reduced by area.
- Changes in standing biomass and biodiversity of associated species.
- Maintenance and restoration of connectivity of natural ecosystems (GBF).

Goal 4. Secure resilient and equitable livelihoods

Target: Secure resilient, equitable and sustainable livelihoods for many millions of seaweed-related farmers and other stakeholders globally by 2030.

Action. By ensuring resilient, equitable, and sustainable livelihoods for many millions of people by 2030, this will position seaweed conservation and sustainable production as a nature-based solution, delivering globally reaching socio-economic and climate co-benefits. Achieving lasting conservation outcomes requires governance systems that are sensitively undertaken, with explicit fair, free, prior and informed consent. These governance systems must support engagement, social inclusion, prioritisation of human and environmental rights, gender equality leadership of local communities including Indigenous Peoples and marginalised communities, who depend upon or live alongside seaweed habitats, in accordance with the Seaweed Guiding Principles.

Integrating human well-being into ecosystem strategies is essential, and protecting biodiversity must go hand in hand with supporting livelihoods. Strong regulations to stop harmful practices should be paired with positive measures such as incentives, financing, and fair market access, so that sustainable practices are practical and equitable. These principles and approaches should be adapted to national contexts and their priorities.

Why resilient and equitable livelihoods matter. Seaweed habitats are both vital biodiversity hotspots and cornerstones of coastal (socio-environment) economies. Seaweed functions and services as well as all other marine and coastal industries, directly and indirectly, support the livelihoods of approximately 600 million people who depend on fisheries and aquaculture[3].

Delivering action. This will be developed through the following illustrative activities:

1. **Inclusive governance and co-management.** Establish frameworks with clear tenure, fair contracts, and accessible finance, ensuring communities and rights holders are equal partners, not just beneficiaries.
2. **Technical capacity building:** Regional programs to strengthen local seaweed research capacity in biological/socio-economic monitoring, pilot protection/restoration, and seaweed research and development in cultivation technology; institutions are linked via knowledge-sharing platforms and partnerships to scale best practices and impact.
3. **Adoption of climate- resilient and bio secure restorative seaweed aquaculture** - with improved market access, product diversification, climate resilient strains/cultivars and strong cooperative structures, and supported by training and farmer extension services.
4. **Awareness, education and capacity building** across the value chain on biodiversity protection, sustainable harvest and safer practices to reinforce conservation outcomes and wellbeing (shared with Goal 1).

Securing livelihoods is inseparable from halting loss (Goal 1), protecting ecosystems (Goal 2), and restoring habitats (Goal 3). By embedding inclusive governance, finance, and capacity building into seaweed ecosystem-based strategies, a virtuous cycle and development of an economic engine are created: healthy ecosystems sustain resilient economies, and empowered communities become stewards of seaweed biodiversity.

Representative indicators:

- Percentage of USD value shared with smallholder producers within global seaweed value chains.
- Percentage of households with improved access to essential services compared to baseline, disaggregated by gender and community.
- Benefits from the sustainable use of wild seaweeds.
- Number of decent jobs provided, aligned with SDG 8 decent work and economic growth (GBF).

Goal 5. Secure sustainable financing for seaweed protection and restoration

Target: Secure investments of at least $17.5 billion USD ($4.4 billion USD year^{-1}) by 2030 to conserve, protect and restore seaweed habitats.

Action. Mobilize $17.5 billion USD globally by 2030 ($4.4 billion USD annually – 2026–2030) through public, private, and innovative financing mechanisms to conserve, protect, and restore seaweed ecosystems. These efforts will integrate ecological, social, and economic objectives, ensuring coordinated action across entire seascapes, rather than fragmented projects. Grounded in inclusive conservation planning, this approach will align finance with global biodiversity goals, climate commitments, and community priorities. Enabling conditions such as clear tenure rights, inclusive governance, and robust Measurement, Reporting and Verification (MRV) systems will reduce risk, unlock scale, and deliver measurable gains for biodiversity, climate resilience, and equitable livelihoods worldwide.

Unlocking Sustainable Finance. Seaweed ecosystems are integral to supporting the $3 trillion USD blue economy yet remain significantly underfunded relative to their ecological and economic importance. Closing this gap positions seaweed conservation and sustainable production as strategic investments in climate adaptation, food security, and inclusive growth. Scaling finance will require combining Financing Green interventions (blended finance, blue bonds, carbon and biodiversity credits) with Greening Finance actions that align financial flows, policies, and standards with nature-positive outcomes.

Finance as a Catalyst. Finance underpins the Seaweed Breakthrough; without it, ecosystem recovery and livelihoods remain vulnerable. Embedding governance and risk-sharing mechanisms creates conditions for scalable investment that delivers biodiversity, climate, and socio-economic returns.

Delivering action. There is a need to strengthen and restore international cooperation, and mobilize diverse financing tools, including blended finance, blue bonds, and outcome-based initiatives to ensure sustained long-term investment. Community-led action, backed by public–private–philanthropic partnerships, will de-risk early implementation. Payments for Ecosystem Services, including carbon finance, combined with regional MRV systems, will strengthen credibility and attract private capital. Aligning policy, conservation, and economic frameworks will provide the legal and institutional foundations needed to mobilize investment at scale.

Representative indicators:

- Number of public and private organisations providing funding, including official development assistance.
- Area of habitat conserved related to funding provision.
- Private/domestic funding and international funding of conservation and sustainable use of biodiversity and ecosystems (GBF).

Terminology and definitions

Convention on Biological Diversity (CBD): A global treaty with three main objectives: conserving biodiversity, sustainably using biological resources, and ensuring fair and equitable sharing of benefits.
Ecosystem: A complex network that combines living organisms (biotic factors), their physical environment (abiotic factors), and the relationships between them within a specific geographical area.
Ecosystem-based approach (EBA): A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.
Ecosystem services: The direct and indirect contributions that ecosystems provide for humans by the intrinsic nature of ecosystem functionality.
Finance for Integrated Protection and Conservation (FIPC) Models: Financial mechanisms combining public, private, and philanthropic resources to support integrated biodiversity protection and conservation.
Habitat: Resources and conditions in an area that enable a specific organism to survive and reproduce.
Kunming-Montreal Global Biodiversity Framework (GBF): Adopted at COP15, the framework sets a pathway for living in harmony with nature by 2050, with 4 goals for 2050 and 23 targets for 2030, supporting the SDGs.
IUCN Green Status of Ecosystems (GSE): A proposed method to assess and track the recovery status of global ecosystem types.
IUCN Green Status of Species: a global standard that measures how close a species is to full recovery, moving beyond just assessing extinction risk.
IUCN Red List: The global standard for assessing the risk of extinction that individual species of animal, fungus, and plant face.
Marine Protected Areas (MPAs): A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.
Marine Spatial Plans (MSPs): A public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives.
Measurement, Reporting, and Verification (MRV): A multi-step process to measure greenhouse gas (GHG) emission reductions from specific mitigation activities, report findings, and verify them through an accredited third party.
Nature-based solutions: Actions to address societal challenges through the protection, sustainable management and restoration of ecosystems.
Nationally determined contributions (NDC): Countries' self-defined climate commitments under the Paris Agreement, detailing their planned actions to reduce greenhouse gas emissions and adapt to the impacts of climate change.
National Biodiversity Strategies and Action Plans (NBSAPs): National frameworks developed by countries to implement the Convention on Biological Diversity, outlining strategies and actions for conserving and sustainably using biodiversity.
National Adaptation Plans (NAPs): Strategic frameworks that help countries identify and address medium- and long-term climate adaptation needs under the UNFCCC process.
Other Effective Conservation Measures (**OECMs):** Areas outside protected zones managed to deliver long-term biodiversity conservation and associated ecosystem and cultural benefits.
Source: CBD – OECMs.
Prioritized ecoregions: These refer to key ecological zones identified by conservation groups, e.g., the World Wildlife Fund (WWF), as the most critical to protect for global biodiversity.
Seascape: Spatially defined, heterogeneous area of the ocean and coastline, encompassing a network of interconnected marine habitats, species, and natural features
UN Decade on Ecosystem Restoration (2021–2030): A global initiative to prevent, halt, and reverse ecosystem degradation worldwide, aiming to restore ecosystems for people, nature, and climate.
UNFCCC – Paris Agreement: A global climate treaty aiming to limit warming to 1.5 °C and achieve net-zero greenhouse gas emissions by 2050.
UN Sustainable Development Goals (SDGs): A global framework of 17 goals addressing environmental, social, and economic dimensions of sustainable development.

Appendix

Goal 1 Target calculation

Kelp loss currently provides the most robust proxy for estimating global seaweed decline, pending a comprehensive biome-wide stocktake[4,5]. Current estimates suggest kelp forests are declining at approximately 2% per year[6], considering gains and losses, making this the best available indicator for other canopy-forming seaweeds. This trend underscores the urgent need for rapid intervention and underpins UN global targets to reduce losses by 70% by 2030 and halt losses entirely by 2040. Mapping and monitoring seaweed habitats at regional scales is critical for building a comprehensive global understanding of their distribution, ecological functions, and conservation status.

Goal 2 Target calculations

Achieving 30% protection of seaweed habitats by 2030 aligns with GBF Target 3 and supports integration with national biodiversity and climate plans. Currently, only kelp has reliable global estimates: modelled habitat is ~1.47 million km^2 [7], with 16% overlapping MPAs and 1.6% highly protected (actual in-situ coverage is likely to cover a smaller area). No reliable global protection data exist for other seaweed habitats. Based on modelled figures, c. 235,200 km^2 are under some protection and 23,520 km^2 highly protected. UN Breakthrough targets would secure an additional 70,560 km^2 of seaweed habitat under protected status by 2030, and/or an additional 7,056 km^2 under highly protected status (expected to increase with improved mapping). By 2050, global protection based on current estimates of total seaweed area would be for approximately 6–7.2 million km^2 of seaweed habitats. However, the true extent of global seaweed area remains a knowledge gap. Baselines will be refined, but current low protection underscores the urgent need to scale up.

Goal 3 Target calculations

The target to restore 30% of losses by 2030 aligns with KM-GBF Target 2 and complements protection goals under Target 3. Baselines will be established through global mapping and regional assessments of seaweed ecosystem extent and integrity (e.g. IUCN GET Levels 5–6). Restoration priorities will be established. It will be important to initially focus on ecosystems with high collapse risk and strong potential for natural recovery but with a push for restoration innovation for ecosystems where potential for strong natural recovery is less likely.

Goal 4 Target calculations

Seaweed ecosystem services both direct and indirect, are assumed to support the livelihoods of approximately 600 million people who depend on fisheries and aquaculture[3]. Building on this, a headline target of 750 million people reflects benefits from seaweed-related ecosystem services and value chains by 2030.

Goal 5 Target calculations

By committing USD 17.5 billion (approximately USD $4.375 billion annually from 2026–2030) to advance the Seaweed Breakthrough— this reflects seaweed's c. 2% share of global ocean coverage and addressing the USD 174.5 billion annual SDG 14 financing gap. For illustrative purposes, funding is projected to be distributed across the 12 CBD Marine Biodiversity Regions, with approximately USD 364.6 million allocated per region annually. Resources will be directed towards (but not restricted to) five indicative core components: management and regional monitoring, governance, habitat protection and ecosystem restoration, and livelihood support (approximately USD 73 million per regional component each year).

References

[1]Corrigan, S., Cottier-Cook, E.J., Lim, P.-E. & Brodie, J. (2025). *The state of the world's seaweeds*. Natural History Museum, London. doi.org/10.5519/4ln9oqk7

[2] Brodie, J., Mallinson, S., Wilbraham, J., Lim, P.-E., Poong, S.-W., Yahya, N., Mrowicki, R. & Cottier-Cook, E.J. (2025). Global seaweed stock and Marine Protected Area assessments provide potential opportunities to protect wild seaweeds. *Applied Phycology* 6: 366-379. https://doi.org/10.1080/26388081.2025.2574676

[3]Cottier-Cook, E.J., Nagabhatla, N., Asri, A., Beveridge, M., Bianchi, P. et al. (2021). Ensuring the sustainable future of the rapidly expanding global seaweed aquaculture industry – a vision. United Nations University Institute on Comparative Regional Integration Studies and Scottish Association for Marine Science Policy Brief. ISBN 978-92-808-9135-5

[4]Krumhansl, K.A., Okamoto, D.K., Rassweiler, A., Novak, M., Bolton, J.J. and Cavanaugh, K.C. et al. (2016). Global patterns of kelp forest change over the past half-century. *Proceedings of the National Academy of Sciences*, 113: 13785–13790.

[5]Vergés, A. & Campbell, A.H., 2020. Quick guide: Kelp forests. *Current Biology*, 30: R919–R920.

[6]Wernberg, T., Krumhansl, K., Filbee-Dexter, K. and Pedersen, M.F., 2019. Status and trends for the world's kelp forests. In: C. Sheppard, ed. *World Seas: An Environmental Evaluation: Ecological Issues and Environmental Impacts*. 2nd ed. London: Academic Press, pp. 57–78.

[7]Jayathilake, D.R.M. & Costello, M.J., 2020. A modelled global distribution of the kelp biome. *Biological Conservation*, 252: 108815.

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