THE OCEAN OPPORTUNITY

A Solutions' Guide for the Blue Economy

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1600+
Clean & Efficient Solutions to Protect the Environment

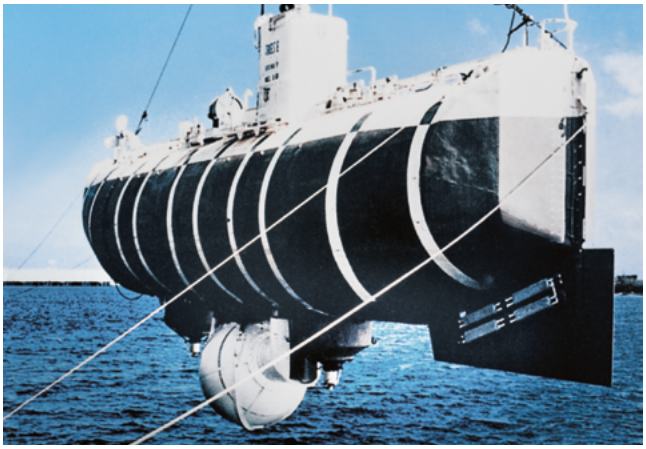
Contents

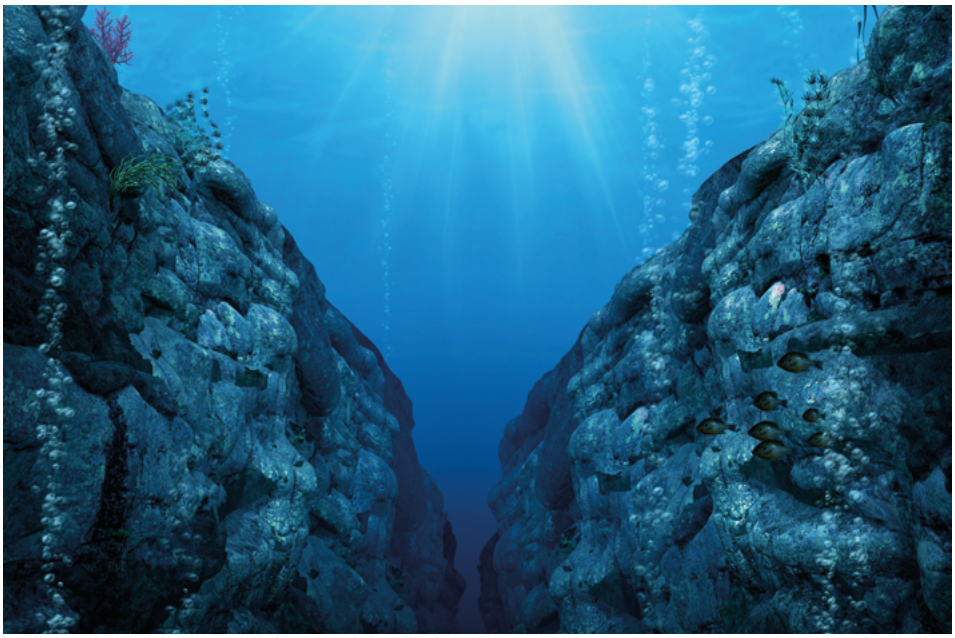
Foreword by

Bertrand Piccard

In 1960, nearly 11,000 meters below the surface, my father Jacques reached the deepest point of the ocean aboard the Bathyscaphe Trieste, developed by his father Auguste. That historic dive was not about chasing a scientific feat – it was a response to a pressing concern.

At the time, some were advocating for dumping nuclear waste into the deep sea, convinced that no life could exist at such depths. By proving the opposite – by observing a living fish where science saw only emptiness – they did not just change a paradigm. They helped prevent an irreversible mistake. That moment captures what exploration is really about: questioning assumptions, opening new paths, and forging a more thoughtful coexistence between humanity and nature.





Today, this mindset is more relevant than ever. The ocean is under siege – from overexploitation, acidification, warming waters, and plastic pollution. But the issue is not only what we do – it's what we still fail to imagine. Jurisdictional gaps, insufficient implementation of international treaties, lack of standards: much remains to be negotiated, adopted, enforced. But we cannot wait for perfect legislation or global consensus. Even within current frameworks, much more can already be done – if we choose to act, and if we realise that acting is beneficial.

That is the purpose of this guide.

It brings together concrete, profitable, high-impact solutions labelled for both ecological efficiency and economic viability. Spanning five essential domains – pollution prevention, marine ecosystem restoration, low-carbon shipping, offshore renewables, and sustainable aquaculture – these innovations are not speculative. They are tested, proven, and ready for deployment.

And they speak the language of business.

Each solution offers a compelling proposition for investors, entrepreneurs, and policymakers: long-term value creation, competitiveness, and resilience. In an era of fragile supply chains and mounting resource pressure, protecting the ocean is no longer just a moral imperative – it is a strategic investment.

The story of the bathyscaphe reminds us: transformative change often begins with a shift in perspective. When we dare to look deeper – into the abyss, into our systems – we discover not emptiness, but untapped potential.

Innovation, when aligned with intelligence and nature, becomes more than a tool. It becomes a compass – pointing us toward a new balance between progress and preservation. This guide is here to make that case. To show that when it comes to exploring the future, we are not short on solutions. We just need the courage to act.

Bertrand Piccard
Founder and President of the Solar Impulse Foundation

WHY THIS GUIDE?

SIF's vision for oceans

The Solar Impulse Foundation (SIF) was established by explorer and psychiatrist Bertrand Piccard with a bold mission: to identify and promote clean, profitable solutions that protect the environment without compromising economic welfare.

At the heart of this vision lies a powerful principle: **Efficiency.**

Efficiency is not just about doing more with less – it's about reconciling human progress with planetary boundaries. It is the engine of a new industrial logic, one that reduces waste, maximises value creation, and enables a sustainable, resilient economy, based on quality, not quantity. With this in mind, the Solar Impulse Foundation has awarded its **Efficient Solution Label** to over **1,600 solutions** that combine environmental protection with economic profitability. These innovations are deployable now and scalable across sectors to accelerate the transition towards sustainability.

The Blue Economy is the epitome of the necessary coexistence between human activity and nature.

This guide, created for the United Nations Ocean Conference (UNOC) 2025, embodies SIF's mission by showcasing practical solutions to marine challenges and mobilising stakeholders to act on climate and ocean health.

In the run-up to UNOC 2025, this guide serves as a practical roadmap for accelerating blue economy innovation. It introduces five thematic chapters, each addressing a critical ocean sustainability challenge, and one cross-cutting chapter on financing and investment. Each chapter highlights Solar Impulse-labelled ocean solutions that offer tangible responses to these challenges. By combining relevant data from the recent report and sources with success stories of innovation and investment, the guide aims to inspire stakeholders – policymakers, investors, businesses and civil society – to champion and scale effective ocean solutions.

Together, these insights reinforce the economic rationale for protecting our ocean.

Every $1 invested in key ocean actions yields at least $5 in global benefits by 2050[1], returns spanning from mangrove restoration, offshore wind, sustainable shipping, and responsible aquaculture. **All these solutions are therefore logical more than just ecological, capable of creating jobs and profit while preserving nature.**

By highlighting these solutions and the financing mechanisms to support them, the guide contributes to UNOC 2025's call to action: unlock the potential of the blue economy for people, planet, and prosperity.

AT THE HEART OF CLIMATE, BIODIVERSITY AND LIVELIHOODS

The Ocean's vital role

Covering 71% of Earth's surface and containing over 97% of the planet's water oceans are among the oldest and most vital components of life on Earth. Formed more than 4 billion years ago[1], they have shaped the evolution of ecosystems, moderated the planet's climate, and nurtured an extraordinary diversity of life, from microscopic phytoplankton to the largest mammals on Earth.[2]

Far from being silent bystanders, oceans have witnessed major planetary milestones, from mass extinctions to early human migrations, and the great maritime journeys that interconnected civilisations.

In addition to providing coastlines where population resides, oceans ensure **food security** for over three billion people globally through fisheries and aquaculture. They also play a critical role in **global trade**, enabling the transport of more than 80% of goods worldwide, and serving as the **invisible backbone of our digital age**, with nearly 99% of international data flows passing through undersea cables. If the ocean economy were considered a country, it would rank as the fifth largest economy in the world, with a gross value added of $1.3 trillion in 1995 to $2.6 trillion in 2020 and over 24 trillion in total asset value.[3,4] Their role does not stop there. Often referred to as the planet's blue lungs, the oceans produce around **50% of the oxygen we breathe, absorb up to 25% of global carbon dioxide emissions, and over 90% of the excess heat generated by greenhouse gas emissions[5], buffering humanity from the worst impacts of global warming.[6]**

It is clear by now: **the ocean does more than just surround us with beauty.**

A healthy ocean supports jobs and food security, drives economic growth, helps regulate the climate, and boosts the well-being and tourism appeal of coastal communities. Its influence stretches far beyond the shore, touching the lives of people all around the world.

Yet oceans bear the cost of human impact, reflecting years of heedless human activity. Ocean temperatures are rising, acidification is intensifying, polar ice caps are melting, and sea levels are climbing – threatening not only marine life, but also the livelihoods and safety of coastal communities, and more broadly, the delicate balance of ecosystems.[7]

The future is not set in the tides. The problems are real - but so are the solutions.

Around the world, a wave of clean, efficient, and profitable innovations are already helping to reverse ocean degradation and enable a thriving blue economy. From low-carbon maritime transport and marine renewable energy to sustainable aquaculture, circular models for ocean plastics, and nature-based restoration, these solutions are not theoretical. They are tested, scalable, and ready for implementation.

The path forward is clear: we must act, and we must act with urgency. This guide is designed to spotlight what can and should be done – showcasing the innovations that are making a difference, and along with the financial and policy levers that can help take them further.

The ocean is not just a victim of climate change, but it is also a powerful ally in solving it.

NAVIGATING OCEAN CHALLENGES

POLLUTION PREVENTION & CIRCULAR ECONOMY INNOVATIONS

From waste to wealth

Few threats to ocean health are as visible, yet solvable, as pollution. From plastic waste and ghost fishing gear to oil spills and chemical runoff, marine pollution continues to degrade ecosystems, harm wildlife, and inflict heavy economic losses on coastal communities. But today, we have the tools to change that trajectory.

Annual plastic production has reached more than 460 million tonnes, yet only 9% of plastic waste is recycled.[8] Every year, an estimated 8 to 10 million metric tonnes of plastic waste enter aquatic environments, polluting rivers, lakes and oceans.[9] A large portion of this plastic accumulates first in rivers, then flows into seas and oceans, where slowly breaking down into microplastics – almost disappearing from human sight. **By 2019, more than 500,000 tonnes of floating microplastics had accumulated on the ocean surface.**[10] Due to the durability of plastic and its non-biodegradable nature, microplastic waste is stuck in ocean currents and gathers at specific convergence zones.[11] Much of this waste accumulates in giant, slow-spinning ocean currents known as gyres. The most infamous is the Great Pacific Garbage Patch, a floating mass of plastic debris between Hawaii and California that spans an area twice the size of Texas. It is a stark symbol of our throwaway economy, and of how quickly mismanaged materials can spiral into planetary-scale crises.

Yet plastics are only part of the problem.

Abandoned fishing gear makes up around 10% of all marine litter and continues to trap marine life long after it's lost at sea.[12] Meanwhile, oil spills, though less frequent, can cause lasting devastation to ecosystems, local economies and tourism industries.[13] Although stakeholders mobilise quickly to clean up affected areas, cleanup efforts can never fully remove the spilled oil. Such events not only harm biodiversity and marine ecosystems, but also undermine tourism and lead to important costs for cleanup operations and lost revenue for the region.[14]

These impacts are significant... but they are not inevitable.

Around the world, a growing number of innovators are turning pollution into opportunity, and waste into value. Circular economy models are now being deployed to intercept ocean-bound plastics, regenerate materials from marine litter, and eliminate waste altogether through sustainable design. Ghost gear is being recovered and transformed into new materials. Natural adsorbents are replacing synthetic booms to clean up oil spills. Monitoring tools are helping communities detect pollution hotspots early and act fast.

The shift is clear: prevention, recovery, and upcycling are no longer fringe ideas. They are profitable, scalable strategies for preventing pollution and building resilient coastal economies.

Notpla

SEAWEED-BASED PACKAGING

Seaweed-based alternatives to single-use plastic: naturally compostable, PFAS-free, and compatible with industrial production lines

> PRIMARILY IN EUROPE, EXPANDING GLOBALLY IN PACKAGING AND FOOD SERVICE INDUSTRIES

Notpla develops innovative materials made from farmed or hand-harvested seaweed to replace single-use plastic in packaging. Their materials are 100% natural, unmodified polymers that meet EU criteria for non-plastic classification under the Single-Use Plastics Directive. Designed as drop-in solutions, Notpla's coatings and films can be integrated into existing packaging processes without chemical alteration. The materials are home-compostable, disappearing in as little as four weeks, and have no reliance on freshwater, fertilisers, or land, hence actively improving ocean health through carbon sequestration and marine habitat creation.

SEAWEED PACKAGING AT SCALE: JUST EAT AND LEVY PIONEER A NEW STANDARD FOR FOOD DELIVERY

Working with Just Eat, a leading food delivery platform in the UK and Europe, Notpla implemented its seaweed-based coating technology across their restaurant network, replacing conventional plastic-lined boxes. This marked the first large-scale commercial deployment of a seaweed-based packaging solution in the food delivery sector, driving significant traction in the wider foodservice and catering industry. In 2024, this success led to a partnership with Levy (part of Compass Group) to supply packaging to 50+ notable stadiums across the UK and Ireland. The implementation involves careful collection of seaweed that's either farmed or hand-harvested when it's washed up by tides, sourced both locally from Europe, as well as other regions like south-east Asia, generating positive ocean impact through regenerative farming practices. By 2024, Notpla's food packaging had been rolled out across 10 European markets in the Just Eat network, replacing millions of plastic-lined containers.

IMPACT ACHIEVED

Economic

- **Achieved price parity with bioplastics, with an additional 20% cost reduction targeted by 2025.**
- **Drop-in design reduces switching costs and operational disruptions for packaging manufacturers.**
- **Simplified downstream waste management, saving on disposal and compliance costs for food distributors and municipalities.**

Environmental

- **3.5 million units of packaging replaced in 2024 alone, saving 5,919 kg of plastic and 66,391 kg CO_2e.**
- **Fully biodegradable in marine environments in under 6 weeks, no microplastic or harmful chemical residue.**
- **Seaweed feedstock enhances ocean health and requires zero freshwater, fertilisers, or arable land.**

Social

- **Supported 50+ full-time jobs at Notpla's London headquarters.**
- **Strenghtened coastal community resilience, particularly in regions affected by the decline of traditional fishing industries, by generating new supply chain opportunities in seaweed harvesting and processing.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

Manufacturing scalability and infrastructure

Scaling production to meet the 100 million-item goal by 2026, while expanding the range of applications across Notpla's portfolio of natural polymers, will require significant investment in manufacturing capacity and specialised infrastructure.

Strategic commercial partners

Actively seeking key collaborations to enable plastic-reduction to reach new heights and bring next-generation material innovation to new markets.

"Improving the packaging used to deliver food to homes is an impactful way for us to help build a more sustainable future for the food delivery sector."

> Jaz Rabadia,
Global head of responsible business and sustainability at JustEatTakeaway.com

LEARN MORE HERE

SARGASSUM: BIODIVERSITY AND WASTE MANAGEMENT

A circular, beachside upcycling model transforming invasive sargassum blooms into compost, biochar, and clean energy while restoring marine ecosystems

> COASTAL AREAS HEAVILY AFFECTED BY SARGASSUM INFLUX, PRIMARILY THE CARIBBEAN, MEXICO, AND PARTS OF WEST AFRICA

Grogenics upcycles sargassum seaweed and local green waste into nutrient-rich compost, biochar, and electricity, all processed within one kilometre of the shoreline. On-site pyrolysis and composting cut transport emissions and enable seamless integration with coastal infrastructure. Collection is carried out using boats and electric vehicles, limiting noise and shoreline degradation, while a patent-pending bioremediation formula removes contaminants such as heavy metals and microplastics.

Collected materials are sorted: smaller branches chipped, biomass windrowed, aerated daily by compost turners, and enriched with Grogenics' in-house biochar. Within six months, this yields high-quality compost that boosts soil fertility, improves yields, and diverts waste from landfills.

December 2024

Mexico

TACKLING SARGASSUM WITH CIRCULAR INNOVATION AT EL DORADO ROYALE RESORT

Grogenics launched its first large-scale Gold Standard project in Quintana Roo, Mexico, replicating its successful model from the Dominican Republic to combat the region's escalating sargassum crisis. Massive sargassum blooms, surging 600% in the last decade, threaten marine biodiversity, coral reefs, and coastal ecosystems while releasing methane and toxic gases that accelerate climate change. In December 2024, Grogenics deployed its innovative solution at El Dorado Royale Resort, focusing on rapid sargassum collection before decomposition.

The harvested biomass is then upcycled into biochar and organic fertilisers, using bioremediation to neutralise heavy metals. This circular economy approach not only protects coastal environments but also transforms waste into valuable resources, setting a scalable model for tackling sargassum across the region.

IMPACT ACHIEVED

Economic

- **Processing costs were kept under $100 per tonne, making it cost-competitive compared to landfill disposal.**
- **Yielded nearly 3,000 tonnes of premium compost in 5 months, reducing the need for imported or synthetic fertilisers.**
- **Fully operational near-resort model integrates into hotel waste systems, offering significant cost savings and added value to sustainability branding.**

Environmental

- **Diverted sargassum from sensitive beaches and landfills, preventing approximately 3,000 tonnes of CO_2 emissions (1:1 conversion).**
- **Helped reduce acidification and eutrophication along the coast by promoting a circular economy.**
- **Converted marine nuisance into a productive resource, creating a model for climate-smart coastal management.**

Social

- **Engaged 12–15 local workers year-round, with additional jobs created during peak bloom seasons.**
- **Strengthened regional agriculture by supplying compost to 150 women-led farms, improving yields and food security.**
- **Promoted healthier beaches and improved public health through methane and hydrogen sulfide mitigation.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

To scale up the sargassum upcycling project, Grogenics is looking for the following key enablers:

Access to new sites
Seeking partnerships with additional resorts and islands to expand collection and transformation efforts by 2026.

Strategic partnerships
Exploring collaborations with carbon market stakeholders, particularly through Internationally Transferred Mitigation Outcomes (ITMOs), to align with global emissions reduction efforts.

Financing needs
Seeking investment to fund the development of new transformation plants for processing sargassum and local green waste at scale.

"The results are incredible – flowers and vegetables have never been this big. Grogenics compost is 100% effective!"

> Tony de la Rosa,
Gardener for Oscar de la Renta,
Punta Cana, D.R.

LEARN MORE HERE

#tide OCEAN MATERIAL

#TIDE OCEAN MATERIAL®

A high quality, versatile material resource made from upcycled ocean-bound plastic

> GLOBAL OPERATIONS WITH COLLECTION POINTS IN SOUTHEAST ASIA AND CENTRAL AMERICA, PROCESSING IN EUROPE (SWITZERLAND), AND PARTNERSHIPS WORLDWIDE

#tide® gives plastic waste a value through Swiss technology and expertise by working with coastal communities to collect, sort, and upcycle plastic into high-quality raw material. Manual work is supplemented by mechanical process and a target oriented compounding. This material, known as #tide ocean material is then supplied to brands and manufacturers for use in new sustainable, durable products. #tide® offers various types of recycled ocean-bound plastics, including PET, PP, HDPE, LDPE, and soon, PA6. In the first 5 years, already more than 80 brands have manufactured products made of #tide ocean material.

HORL ADOPTED #TIDE OCEAN MATERIAL© TO CREATE SUSTAINABLE KNIFE SHARPENERS

November 2024

Germany

HORL is a German family-owned company manufacturing rolling knife sharpeners. The owners came up with the design of their product a little less than 10 years ago and has since taken over the world of professional chefs and ambitious homecooks.

In 2024, HORL decided to try something new: Instead of wood, they used #tide ocean material© (recycled ocean-bound polypropylene) for the entry level Horl3 Cruise knife sharpener.

The Cruise is meant as a cost efficient product to open up new markets. With the revamped product and material there came whole new possibilities for marketing and the Horl3 Cruise is a huge success.

IMPACT ACHIEVED

Economic

- **By using #tide Ocean Material, HORL was able to offer its innovative rolling knife sharpener with the HORL®3 Cruise to a wider audience at a more affordable price.**
- **In conjunction with an optimisation of features and more intensive marketing, sales figures have tripled compared to the previous model HORL®2 Cruise.**

Environmental

- **15,000 kg of ocean-bound plastic waste was collected and repurposed into high-quality polypropylene granules for this first batch.**
- **The resulting material has 50% lower CO_2 emissions than virgin polypropylene, confirmed by an independent Life Cycle Assessment conducted by Carbotech and reviewed by MyClimate.**

Social

- **Plastic waste is collected by fishermen and independent waste pickers in coastal areas of Southeast Asia and Central America, creating direct economic opportunities in regions heavily impacted by pollution.**
- **Sorting and pre-processing is carried out in social enterprises, employing and training ethnic minorities, including Moken and Burmese communities in Thailand, thus embedding social equity into the value chain.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

#tide is entering a pivotal growth phase, with a focus on scaling its impact across regions, deepening partnerships, and expanding plastic collection and processing infrastructure.

Series A funding & grant acquisition
Seeking investment and grant support to accelerate the scale-up of plastic collection and transformation.

Infrastructure expansion
Developing new local hubs in key regions to increase collection capacity and strengthen supply chain resilience.

Strengthening strategic partnerships
Deepening collaborations with NGOs like Help Alliance and WWF, along with industry partners and coastal communities, to drive systemic change through shared value.

"By using #tide Ocean Material, HORL was able to offer its innovative rolling knife sharpener with the HORL®3 Cruise to a wider audience at a more affordable price. In conjunction with an optimisation of features and more intensive marketing, sales figures have tripled compared to the previous model HORL®2 Cruise."

> Julian Ruf,
R&D Director at HORL

LEARN MORE HERE

ADVANCED MATERIALS FROM RECYCLED NYLON

Transforming end-of-life fishing nets into high-performance materials for design, industry, and manufacturing

> COASTAL FISHING COMMUNITIES, PARTICULARLY IN THE UK (PILOT IN CORNWALL), BUT APPLICABLE GLOBALLY WHERE FISHING NET WASTE IS PREVALENT

0rCA® (formerly known as Fishy Filaments) provides a containerised, deployable system for recycling Nylon PA6 monofilament fishing nets. In partnership with Fillamentum, their production and distribution partner, they turn discarded nets from the MSC certified Cornish Hake fleet into high-quality, 100% recycled nylon filament, powders and pellets. Their low-energy mechanical recycling process yields a low carbon material that supports a circular economy, offering strength, durability, and a significant reduction in plastic pollution and nylon's environmental impact.

January 2022
The Netherlands

CIRCULAR LIGHTING: SIGNIFY ADOPTS ORCA® RECYCLED NYLON FOR COASTAL BREEZE COLLECTION

Signify, formerly known as Philips Lighting N.V., created the "MyCreation" brand to deliver a more sustainable approach to lighting for both consumer and commercial markets. From the start, MyCreation aimed to reduce carbon impact, and as the project expanded pre-COVID, the team sought materials that aligned with this vision and could meet future design regulations. 0rCA® (whilst still known as Fishy Filaments) answered that challenge with recycled polymer materials, leading to the Coastal Breeze collection crafted from 100% recycled Porthcurno blend. Around 750 kg of this material was sold for use in creating the lamps. These luminaires are 3D printed on demand at Philips Lighting's regional print farms and launched across both EU and US markets. The collection went on to win Gold at the 2022 IDEA awards from the Industrial Design Society of America.

IMPACT ACHIEVED

Economic

- **£300–500/tonne avoided landfill costs for UK fisheries.**
- **With a 95% recycling efficiency, recycled filament sells at an average of £50+ per kg.**
- **Supports low-cost, high-value circular models for design-led manufacturing.**

Environmental

- **Tensile modulus of 2200 MPa, delivering industrial-grade performance.**
- **Emissions 46× lower than traditional nylon, at just 0.2 kg CO_2e/kg.**
- **Diverts persistent plastic from marine environments, mitigating ghost gear pollution.**

Social

- **Enables fishers to repurpose time during off-sea periods into recycling tasks, repairing nets, salvaging materials, and preparing nylon for processing.**
- **Active collaboration with 14 boats from the Newlyn fishing community, reinforcing sustainable marine practices and local economic participation.**

"As a clear and unambiguous signal to the rest of the industry of where Signify is now and the direction it intends to take, your Porthcurno blend of recycled nylon couldn't be better."

> Kevin Raaijmakers, Head of Growth, at Signify N.V.

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

0rCA® is now gearing up for its next wave of impact.

Product launch

Preparing the commercial launch of a world-first, ultra-low carbon powdered version of its recycled nylon enhanced with recycled carbon fibre for Selective Laser Sintering (SLS) in additive manufacturing. Working with Alpha Powders (Poland) and seeking partnerships to maximise its market potential.

Revenue growth

Expanding sales of bulk raw materials, aiming to reach profitability based on these product lines alone within the next 1–3 years. This presents an opportunity for off-takers and buyers in the lighting, furniture, eyewear, and industrial design sectors looking to decarbonise their supply chains with high-performance, recycled inputs.

Global demand for hardware

Receiving enquiries from Bahrain, Uganda, and India for local recycling units, deployment will require blended finance and implementation partners.

Capital & partnerships

Seeking a corporate or mission-aligned investor to accelerate scaling and replicate its containerised recycling solution globally.

LEARN MORE HERE

CLIC SEA

Biodegradable, data-driven barriers made from recycled human hair, capturing marine pollutants and transforming ports into cleaner, circular systems

> WATER INTERFACES (LIKE PORT ENTRANCES OR ALONG DOCKS) WHERE POLLUTANTS SUCH AS HYDROCARBONS AND HEAVY METALS ENTER THE MARINE ENVIRONMENT

CLIC SEA Smart Sea Decontamination Barriers are innovative, biodegradable solutions designed to combat marine pollution. Made from recycled human hair waste – a regenerative local natural resource – they naturally and efficiently adsorb hydrocarbons and heavy metals from water resources, offering a sustainable alternative to plastic-based products. Equipped with IoT sensors and real-time data tracking, they monitor water quality, providing valuable insights for environmental management. Ideal for ports, marinas, and coastal industries, they support marine ecosystem protection while aligning with circular economy principles.

CLIC SEA DECONTAMINATION BARRIER PILOT IN THE PORT OF BARCELONA

CLIC SEA Decontamination Barriers were deployed in the Port of Barcelona during 2023 and 2024 under a grant from The Agency of Waste of Catalonia. Multiple designs have been tested and analysed to ensure an end product that efficiently adsorbs heavy metals and hydrocarbons and is suitable for the port's water, while being easy to use and handle by port personnel. Thereafter Smart Decontamination Barriers equipped with sensors to measure water quality parameters, such as turbidity, temperature, and dissolved oxygen were deployed to track water quality with real time data in a mobile application and an IoT platform.

These parameters were defined in collaboration with the Port introducing advanced technology, including a self-cleaning digital multi-parameter sensor, a solar-powered data logger, and a platform for data collection and analysis. The 36 CLIC SEA Decontamination Barriers performed significantly better than conventional decontamination products at adsorbing hydrocarbons and heavy metals, making them a viable alternative for marine pollution control in ports, coastal environments, and shipping areas.

IMPACT ACHIEVED

Economic

- **The standard solution, a single-use 6-meter polypropylene barrier, typically costs €434.88. CLIC SEA's equivalent costs €350, and is reusable up to 4 times, lowering effective cost to €87.50 for 2 uses.**
- **Real-time data monitoring helps reduce regulatory risk, improves reporting, and boosts attractiveness for eco-conscious port clients and certifications.**

Environmental

In one year, 36 CLIC SEA Decontamination barriers removed:

- **4,320 kg of hydrocarbons.**
- **50.5 g of heavy metals, and led to.**
- **1,080 kg of hair waste transformed.**
- **625 kg of polypropylene products displaced.**

Social

- **Created 4 jobs in local manufacturing, collection, and deployment, while helping ports meet rising environmental standards, enhancing their reputation, license to operate, and stakeholder trust.**
- **Strengthened urban circularity, activating new economic channels through waste recovery and ecosystem restoration.**

"As a member of BlueTechPort, the Port of Barcelona's innovation hub, Clic Recycle plays a strategic role in the ecosystem thanks to its sustainability- and digitalisation-driven approach, as well as its active participation in events and activities that foster collaboration and open innovation."

> Carles Rua,
Head of Innovation
at Port of Barcelona

LEARN MORE HERE

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

CLIC RECYCLE is entering a critical growth phase, with new grants, partnerships, and pilot programs positioning the company to scale its circular, nature-based water purification technologies across Europe and beyond.

Strategic pilots & partnerships
Advancing partnerships with the Creative Innovation Lab in Stockholm, with pilot projects planned in the Nordics and Rotterdam to adapt and implement the solutions in new geographies.

Circular partnership with L'Oréal
Strengthening their collaboration with L'Oréal and the Hairstylists for the Future program in Spain and Portugal, expanding their salon network in 2025 to ensure a consistent supply of raw materials for their circulatory system.

Funding round underway
Currently raising their first round of funding to scale operations, launch new pilots, and accelerate commercialisation of their bio-based, nature-driven technologies.

Nature-based water purification
Enhancing biodiversity and ecosystem resilience by using hair fibers to support vegetation and marine life – creating habitats, improving water quality, and mitigating coastal degradation.

MARINE ECOSYSTEM RESTORATION

MARINE ECOSYSTEM RESTORATION

> Restoring life below water

Pollution prevention is only half the battle. To truly restore ocean health, we must repair the damage already done. Decades of human activity, from offshore drilling to unregulated tourism and unchecked coastal development have severely degraded marine ecosystems, leading to biodiversity loss and hindering their natural ability to regenerate.[15]

In addition, climate change impacts the ocean by warming its waters, increasing ocean acidification, altering currents, and amplifying the effects of natural disasters on land, severely affecting coastal economies.[16]

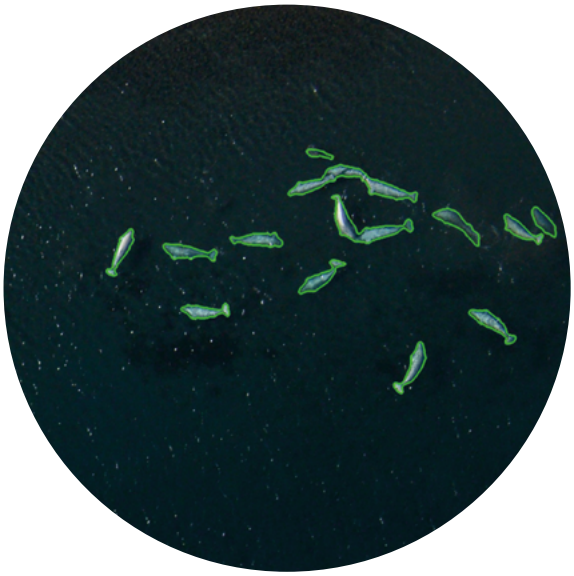
Coral reefs are under siege: ocean acidification weakens their skeletons, while thermal stress causes mass bleaching.[17] Between 2009 and 2018 alone, the world lost 14% of its coral reefs, equivalent to more than all the coral in Australia. [18]

Yet, despite their importance, **marine protected areas[19], which have existed for decades to preserve marine wildlife, only cover 8.34% of the ocean.**[20] These protected zones are essential for the recovery of declining and endangered species. Mangroves, coral reefs, and seagrass beds are vital indicators of ocean health. By promoting their restoration and growth, carbon dioxide can be sequestered at rates even higher than those of terrestrial forests.[21] For instance, mangroves not only enhance water quality but can store approximately 1,000 tonnes of carbon per hectare within their biomass and soil layers.[22]

The ocean ecosystem, although only about 10% documented so far, is ingenious.[23] Ocean mammals, particularly whales, play specific vital roles in maintaining ocean biodiversity. Thanks to their yearly migrations, these mammals release nutrients through their urine and feces, enriching ocean environments along their routes.[24] Identifying and mapping new species is paramount to understanding and strengthening ocean resilience.

The good news: the ocean has an extraordinary ability to heal, if given the chance.

And around the world, a new generation of restoration-focused innovations is making that possible. From AI-powered marine biodiversity monitoring, coral reef regeneration to blue carbon mapping and ecosystem-safe nurseries, the solutions are already here. Nature-based approaches, such as the restoration of mangroves and seagrass meadows, offer powerful dual benefits: enhancing biodiversity while capturing carbon at rates often higher than terrestrial forests.



WHALE SEEKER™

MÖBIUS

A human-in-the-loop AI solution that detects marine mammals from aerial images for all marine stakeholders

> COASTAL AND OFFSHORE REGIONS WHERE MARINE MAMMALS (ESPECIALLY WHALES) ARE PRESENT

Möbius is a human-in-the-loop AI platform for non-real-time aerial image analysis to detect marine mammals. It automates detection with high accuracy while retaining expert oversight. The platform reduces analysis time from weeks to hours, increases detection rates, and integrates easily into existing workflows. The technology helps maritime industries comply with regulatory or value-driven sustainability goals, empower development projects to minimise the impact on biodiversity, and enable governments to establish evidence-based policy and manage protected areas.

January 2024

Canada

MÖBIUS ADOPTED BY TRANSPORT CANADA TO REVOLUTIONISE ARCTIC MARINE MAMMAL MONITORING

Transport Canada, in collaboration with Whale Seeker, is using AI-powered Möbius to address the critical endangerment of the North Atlantic Right Whale (NARW) by improving monitoring efforts. The AI platform analyses aerial survey imagery of the Gulf of St. Lawrence, detecting NARWs faster and more accurately than manual analysis of aerial images, reducing analysis time from weeks to hours. This enhanced detection provides real-time data to Transport Canada, enabling quicker regulatory responses, such as adaptive speed restrictions and ship route adjustments, while minimising economic disruptions. Möbius's scalability and adaptability make it a powerful tool for expanding marine conservation efforts, improving regulatory compliance, and setting the stage for broader ecosystem management, including offshore wind and marine protected areas.

IMPACT ACHIEVED

Economic

- **Reduced costs of aerial survey programs by up to 50%, eliminating the need for full-time onboard observers and extending the utility of each flight mission.**
- **Enabled faster decision-making for regulatory bodies, reducing the risk of shipping delays and legal exposure for non-compliance.**
- **Scaled efficiently across geographies without major new infrastructure investment.**

Environmental

- **98% reduction in GHG emissions per operation by replacing fuel-intensive surveys with AI-based image analysis.**
- **Enabled 100% analysis of collected imagery, increasing the likelihood of timely detection and protective action for vulnerable marine species.**
- **Supported better ecosystem stewardship by detecting patterns and trends invisible to traditional methods.**

Social

- **Encouraged cross-sector collaboration between regulators, private sector, and conservation scientists.**
- **Freed up up public resources for higher-impact marine research and community-based initiatives.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

To scale its impact, Möbius is now poised for broader deployment across both public and private sectors. Key areas of opportunity include:

National marine conservation programs
Governments looking to enhance biodiversity protection and strengthen monitoring of endangered species can adopt Möbius to gain high-frequency, high-accuracy data while reducing program costs.

Offshore wind developers
Möbius offers an efficient and scalable way for renewable energy actors to meet environmental compliance obligations, such as marine mammal monitoring during construction and operation phases.

Maritime insurers
As ESG and biodiversity risks rise, Möbius can support insurers in developing new monitoring-based risk models, integrating biodiversity metrics into underwriting decisions.

"We are pleased to be working with Whale Seeker again this year to advance Canadian technologies for marine mammal detection that contribute substantially to delivering our surveillance mandate."

> Mark McKeeman,
Acting Director, Remotely Piloted Aircraft System (RPAS) at Transport Canada

LEARN MORE HERE

RRREEFS – RETHINKING, REBUILDING, REGENERATING

An all-in-one holistic solution featuring a 3D-printed modular system to regenerate coral reefs and boost coastal biodiversity

> CORAL REEF ZONES SUFFERING CORAL BLEACHING, DYNAMITE FISHING, DREDGING, EROSION AND OTHER FORMS OF DEGRADATION (TROPICAL AND SUBTROPICAL COASTAL AREAS)

rrreefs has developed a modular artificial reef system made from terracotta clay that stacks like LEGO, enabling endless design variations using just one module type. This solution is ideal for coastal reef areas, including partially or fully degraded reefs, resort reef attractions, and mitigation sites, and can also support coral transplantation efforts. Currently scalable up to one hectare, the system regenerates coral by attracting larvae and providing safe, structured spaces for growth, while also encouraging the return of herbivores to naturally control algae. It can be effectively combined with coral nurseries and outplanting strategies to enhance reef restoration efforts where habitat is missing.

2024
Philippines

RESTORING CORAL AND COMMUNITY IN THE PHILIPPINES: RRREEFS IN PUJADA BAY

In February 2024, rrreefs launched its largest reef regeneration project in Pujada Bay, Philippines, covering over 100 m² of reef area in 2024 and more than 250 m² in 2025, with a hectare planned in 2027. Pujada Bay, a Marine Protected Area since 1994, faces significant threats such as overfishing and coral degradation. The project began with 820 3D-printed terracotta modules designed to promote coral growth and marine biodiversity recovery, with scientific monitoring conducted every six months by university partners. In collaboration with local partners, including the Department of Environment and Natural Resources, Davao Oriental State University, and the Coastal Conservation and Education Foundation, the project integrates community participation. Additionally, it combines coral reef regeneration with mangrove reforestation, partnering with Team Malizia, the Mama Earth Foundation, and Zurich Gruppe Deutschland to restore reefs and plant 9,000 mangroves at the same time, strengthening both community involvement and government support.

IMPACT ACHIEVED

Economic

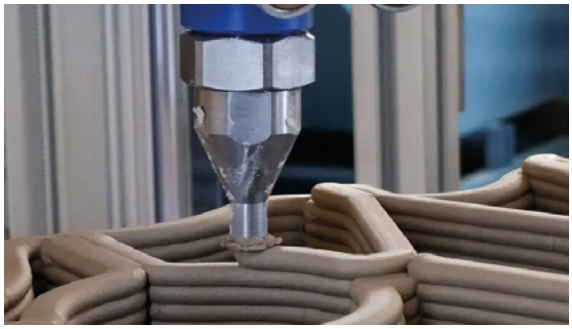
- **Enabled the creation of a 3D-printed reef manufacturing site in the Philippines, anchoring regional supply chains and circular materials sourcing.**
- **Reinforced the ecotourism potential of Pujada Bay by restoring its underwater attractions and increasing visibility as a reef regeneration destination.**

Environmental

- **Within 5 months, the restored reef supported 1,200 coral recruits across 100 m²; this number tripled in 12 months.**
- **Over 4,000 new corals now populate the regenerated site.**
- **Fish abundance and diversity exceeded that of the control site by 30%, with 9 fishery-relevant species observed exclusively in the restored area (compared to just 1 in the control zone).**

Social

- **Over 40 local residents participated in hands-on reef installation and mangrove planting.**
- **School programs reached over 8 schools, embedding ocean awareness at a local level.**
- **A CHF 370,000 grant was unlocked of which CHF 200,000 will go directly to local economic development through strong multi stakeholder collaboration, funding new training in scientific diving, marine monitoring, and sustainable fishing incentives.**



DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

rrreefs is entering a pivotal growth phase focused on scaling reef restoration through tourism partnerships, local production, and strategic investment.

Funding

Currently raising a bridge round of CHF 400,000 via CLAs; a €2M seed round is planned for Q4 2025.

Tourism expansion

Targeting the tourism sector in 2025, with plans to build the first reefs for resort hotels: pilot customers are actively being sought.

Production milestone

The first local production facility is nearly operational, with a focus on scaling deployments: corporate partners in the Philippines are invited to join reef regeneration efforts.

Partnership opportunities

Seeking collaboration with resorts, hotel groups, coastal developers, and sustainability managers interested in marine ecosystem restoration.

"Our clients, business partners and employees are thrilled with our collaboration with rrreefs – a strong, passionate team and an innovative, scalable approach to healthy oceans."

> Dr. Carsten Schildknecht, CEO at Zurich Group Germany

LEARN MORE HERE

ECONCRETE

BIO-ENHANCING CONCRETE TECH

A science-backed, bio-enhancing concrete technology that turns marine infrastructure into thriving habitats, restoring biodiversity at scale

> URBAN WATERFRONTS, PORTS, SEAWALLS, BREAKWATERS, UNDERWATER INFRASTRUCTURE GLOBALLY

ECOncrete's patented technology integrates a bio-enhancing concrete admixture that alters the chemical composition of concrete to support marine life colonisation while lowering its embodied carbon footprint. Its surface complexity fosters the settlement and growth of local marine fauna and flora, and its nature-inclusive design ensures that all solutions meet structural requirements while simultaneously creating thriving marine habitats. ECOncrete's work is grounded in rigorous science and operational deployment across diverse ecosystems, during which it has developed advanced monitoring frameworks and assessed over a decade of ecological data.

LIVING BREAKWATERS IN STATEN ISLAND: BUILDING COASTAL RESILIENCE THROUGH NATURE-INCLUSIVE INFRASTRUCTURE

The Living Breakwaters project in Staten Island was initiated after Hurricane Sandy's impact on the area in 2012, especially the Tottenville neighborhood, which suffered severe erosion and flooding. Following the disaster, the federal Rebuild by Design competition was launched to develop coastal resilience solutions. The Living Breakwaters project, led by SCAPE Landscape Architects and partners including WSP and Arcadis, involves eight breakwaters designed to reduce erosion, minimise wave energy, and restore marine ecosystems. ECOncrete's eco-engineered solutions, including hundreds of Armor Blocks and Tide Pool Armor units and provide 2.13 m² of colonisable surface area per Tide Pool unit and 4.42 m² per Armor Block unit, support marine biodiversity and enhance local ecosystems while protecting communities from future storms. The project also promotes biodiversity restoration by providing habitat for oysters, mussels, and other marine organisms, contributing to carbon sequestration and enhancing the local marine food web.

IMPACT ACHIEVED

Economic

- **Total project investment: $111 million, co-funded by the U.S. Department of Housing and Urban Development and the New York State Office of Resilient Homes and Communities.**
- **ECOncrete's bio-enhancing design led to ~80% reduction in mitigation penalties, eliminating the need for off-site environmental compensation.**
- **Long-term operational savings are projected through lower maintenance and enhanced resilience of infrastructure.**

Environmental

- **Enabled measurable habitat creation and biodiversity uplift, supporting oysters, mussels, and marine vegetation.**
- **Reduced the embodied carbon of infrastructure with a 92% carbon-neutral concrete admixture.**
- **Reduced the embodied carbon of infrastructure with a 92% carbon-neutral concrete admixture.**
- **Designed to withstand storm surges and sea level rise, ECOncrete simultaneously functions as grey infrastructure and green restoration.**

Social

- **Fostered public stewardship through partnerships with local schools, citizens' groups, and the Billion Oyster Project.**
- **Created accessible waterfront zones that promote marine awareness and recreational engagement.**
- **Integrated community input from the earliest design stages, making it a model for participatory coastal adaptation.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

To accelerate the adoption of eco-engineering solutions in marine infrastructure, key deployment levers must be activated:

Regulatory frameworks
Introducing stricter standards and mandatory reporting to drive environmental accountability.

Nature-credit markets
Activating nature-credits through cross-sector collaboration to incentivise investment in nature-positive solutions.

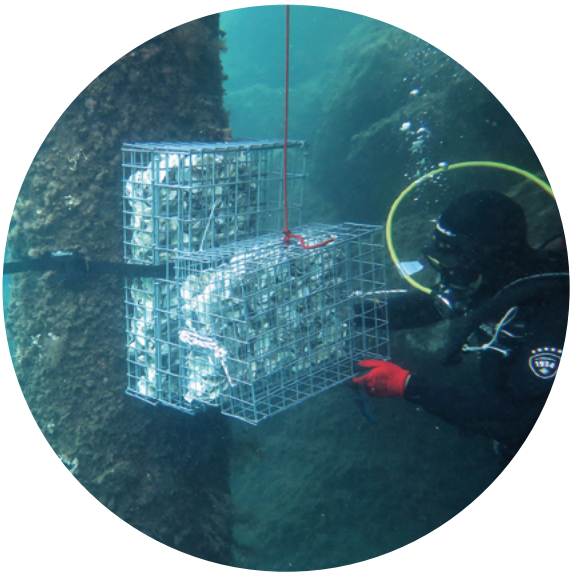
Performance-based financing models
Developing financing models that link implementation costs to measurable ecological outcomes, encouraging long-term responsibility and reliable metrics.

External expertise
Leveraging ecological consulting expertise to support infrastructure owners from early design to monitoring, optimising environmental performance across project lifecycles.

"This $111 million investment is an innovative way we can diminish many of the dangerous effects of a changing climate. The 2,400-foot breakwater structures will reduce the strength of waves coming to shore, help combat erosion and enhance the local marine life at the same time.

> RuthAnne Visnauskas,
Commissioner at New York State Homes and Community Renewal

LEARN MORE HERE



ecocean
Raised to be wild

BIOHUT

Artificial nursery habitats that replicate essential marine functions bringing biodiversity back to human-modified coastal environments

> HARBORS, MARINAS, DOCKS, PORTS, ESPECIALLY IN THE MEDITERRANEAN BUT EXPANDING WORLDWIDE

Biohut is an innovative habitat restoration system designed to reintroduce essential nursery functions to artificial coastal infrastructure. Built from recyclable steel and filled with oyster shells, each Biohut module mimics the structure and ecological function of natural nurseries, providing shelter and food for juvenile fish during their most vulnerable life stages. Modular and adaptable, Biohuts can be installed on dock walls, breakwaters, pontoons, and piles, and are most effective when deployed as interconnected networks. Their ecological performance has been validated through numerous independent scientific studies.

January 2014
Monaco

BIOHUT RESTORATION PROGRAM IN MONACO PORTS: TEN YEARS OF URBAN BIODIVERSITY GAINS

Since 2014, the Société d'Exploitation des Ports de Monaco (SEPM) incrementally installed 78 Biohuts across Port Hercule, Port de Fontvieille, and the Yacht Club de Monaco, making Monaco's harbors early pioneers in ecological restoration along the Mediterranean coast. These artificial habitats simulate natural nursery conditions, creating safe havens for juvenile fish in otherwise inhospitable urban marine environments. Since 2016, several phases of ecological monitoring, conducted in collaboration with the RESPIRE network, have tracked the evolution of biodiversity.

The results are compelling: numerous species have returned to the port waters, including rare and protected ones such as the brown grouper (*Epinephelus marginatus*) and bushy-tentacled blenny (*Hypleurochilus bananensis*). The project also established a standardised system to assess habitat use, fish population recovery, and long-term ecosystem trends.

IMPACT ACHIEVED

Economic

- **Annual maintenance cost: €18,000.**
- **Led to indirect economic value through enhanced port image, environmental leadership, and tourism appeal.**
- **Active evaluation underway on the correlation between marine biodiversity and port-based economic activities, including recreational boating and eco-tourism.**

Environmental

- **14 species of juvenile fish and 93 species of mobile fauna observed within Biohut modules across Monaco's ports.**
- **Biohut has been validated via BACI protocols, confirming its ecological performance in restoring nursery functions and promoting biodiversity in artificialised zones.**

Social

- **Robust outreach initiatives have educated and engaged thousands of local residents, schoolchildren, and tourists.**
- **The project has become a symbol of Monaco's commitment to marine biodiversity, fostering local pride and stewardship.**
- **Biohuts offer an accessible and tangible way for urban populations to reconnect with the sea.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

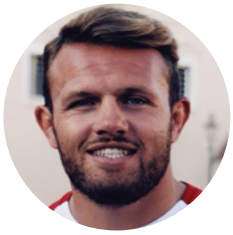
Building on the success in Monaco, Ecocean is seeking to replicate Biohut deployments internationally, particularly in regions with high levels of port infrastructure and degraded marine habitats. The next phase will focus on:

Partnership establishments

Collaborating with local universities, NGOs, and coastal authorities to adapt Biohut designs to local ecosystems and generate community ownership. Scaling up public-private collaboration to support large-scale deployments in harbors, marinas, and coastal developments.

Ecosystem integration

Integrating Biohut into nature-based infrastructure strategies, offering a cost-effective and proven complement to grey coastal engineering.



"As a partner since 2014, we are proud to have been the first ports on the Mediterranean coast to commit to reclaiming biodiversity, through the NAPPEX ecological enhancement and restoration program. Ten years later, the installation of 78 Biohuts illustrates the strong and constant commitment of SEPM, since the beginning of its concession, to the sustainable preservation of natural heritage and marine biodiversity."

> Jean-Christophe Soler,
Environment-Safety Officer at Société d'Exploitation des Ports de Monaco (SEPM)

LEARN MORE HERE

BOUYGUES

MARETERRA

A large-scale, state-led coastal development that prioritised environmental protection through avoidance, minimisation, and compensation measures

IMPLEMENTING THE FULL MITIGATION HIERARCHY: MONACO'S MARETERRA AS A MODEL FOR SUSTAINABLE COASTAL DEVELOPMENT

On 4 December 2024, Monaco inaugurated Mareterra, a six-hectare land reclamation project designed with unprecedented environmental ambition. From the outset, the State of Monaco and its project partners (L'Anse du Portier, Bouygues Construction) committed to a full impact mitigation hierarchy: avoiding, reducing, and compensating for ecological disruption.

To avoid harm, 500 m² of Posidonia oceanica, a world record at this scale, were transplanted with a very high survival rate after 7 years, alongside 143 noble pen shells (Pinna nobilis) and 8 red algae-covered rocks, marking global firsts. To reduce residual impacts, turbidity was tightly managed using underwater screens, adapted dredging sequences, and real-time water quality monitoring. Where impact was unavoidable, extensive compensatory measures were deployed: over 24,000 m² of eco-designed dike surfaces, including 1,000 fauna-friendly structures were integrated into marine infrastructure. Additionally, 11 nearby reefs (4 artificial reef villages and 7 natural rocks reefs), 4 kilometers of flora-like cables and 365 biomimetic sea urchin structures were installed to enhance biodiversity. Finally, 3,600 m² of the nearby Spélugues coral reef were cleaned and restored.

As a final measure, the top of the Spélugues reef was cleaned of 350 m³ of anthropogenic debris, preparing the area for future restoration.

IMPACT ACHIEVED

Economic

- **The project illustrates how coastal development aligned with marine protection can enhance real estate value, eco-tourism potential, and national branding.**
- **Monaco's strong sustainability commitments continue to attract investment from ESG-focused stakeholders.**

Environmental

- ***Caulerpa taxifolia*, an invasive species, was removed from the site (2 tonnes), helping regenerate the native ecosystem.**
- **After several years, biodiversity on the artificial structures began accelerating, with marine life colonising the deeper areas at a slower pace.**
- **The Spélugues reef saw an increase in marine coverage from 55% (2017) to 65% (2024), evidencing gradual recovery.**
- **Fish populations remained stable throughout the project.**

Social

- **All interventions were scientifically monitored, setting new baselines for ecological performance in coastal construction.**
- **The project offers educational value and sets a precedent for integrating environmental engineering into luxury real estate development.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

Monaco's Mareterra project raises the bar for coastal urban development. Its successful integration of marine restoration within a real estate expansion offers a replicable model for small island states and coastal cities.

Going forward, the project's science-based methods and results can support:

- Policy frameworks on marine compensation standards
- Replication of eco-dike design elements
- Deeper engagement with nature-based infrastructure finance

"I wanted this new area to embody the excellence and conviviality which distinguish the Principality of Monaco so well. Mareterra will integrate perfectly with our shoreline and, in a few years, will be seen as a natural extension of our territory."

> HSH Prince Albert II of Monaco

DECARBONISATION OF MARITIME TRANSPORT

A cleaner global fleet is at hands' reach

The maritime sector is the engine of global trade, responsible for transporting over 80% of the world's goods and anchoring economic activity across continents.[25]

Yet this vital sector is also a major contributor to climate change, accounting for roughly 3% of global greenhouse gas emissions, with projections indicating that emissions from shipping could rise by up to 130% by 2050 if left unchecked.[26]

With over 105,000 cargo ships navigating the oceans today, and maritime trade volumes set to triple by 2050, the pressure is mounting for shipping to decarbonise rapidly and at scale.

Fortunately, change is underway. Driven by tightening international regulations – such as the IMO's Carbon Intensity Indicator (CII) and Energy Efficiency Existing Ship Index (EEXI) – alongside regional frameworks like the EU Emissions Trading System (ETS), the shipping industry is beginning to embrace transformative solutions, with several major players of the sector having committed to net-zero by 2050, investing in alternative fuels and technological innovation. New propulsion technologies like suction sails, wind rotors, and low-emission fuels, alongside digital optimisation systems and port electrification, are redefining what a modern, climate-aligned fleet can look like.

However, this transition is capital intensive. An estimated $1.4 trillion will be needed between now and 2050 – equivalent to $50–70 billion annually[27] – to halve emissions from global shipping. Yet the economic rationale is compelling: these investments not only reduce fuel costs and future-proof vessels against regulatory penalties but also unlock new value through enhanced ESG performance and customer demand for cleaner logistics.

This chapter highlights concrete examples of next-generation maritime decarbonisation technologies, from wind-assisted propulsion systems retrofitted onto ro-ro vessels, to port-integrated floating solar platforms. These innovations are no longer pilots or prototypes: they are cost-competitive, operational, and ready for widespread deployment.

And they prove a critical point: Cleaner shipping is economically viable – and increasingly, commercially necessary. Early movers are positioning themselves to lead the future of maritime trade, while laggards risk losing access to capital, markets, and customers. The transition is not just about climate, or about compliance; it's emerging as a core profitability strategy for the next era of global logistics.

D-ICE ENGINEERING

OCEANWINGS

OCEANICS + OCEANWINGS

> OFFSHORE, POLAR, AND COMMERCIAL SHIPPING ENVIRONMENTS

A complete ship navigation system considerably reducing fuel consumption and emissions while maximising safety

D-ICE Engineering offers comprehensive maritime and technical services, from project studies and system integration to user training and operational monitoring. All technologies are developed in-house for tailored, interoperable solutions. Their OCEANiCS system optimises ship routes using external data like weather and wind to cut fuel consumption.

A two-element wingsail installed on vessels

OceanWings is an advanced wind-assisted propulsion system designed to reduce emissions and future-proof maritime fleets. Its modular and lightweight wingsails are engineered for easy integration into both retrofit and newbuild projects, requiring low power and having minimal impact on cargo space.

OCEANICS BY D-ICE ENGINEERING AND OCEANWINGS IMPLEMENTED BY ALIZÉS/JIFMAR GROUP IN MARSEILLE (FRANCE) IN 2023

Canopée, a 121-meter roll-on/roll-off vessel to transport Ariane 6 spacecraft components between Europe and French Guiana while minimising fuel consumption, emissions, and operating costs. Developed by Neptune Marine with support from Groot Ship Design, Zephyr & Borée, VPLP and the Jifmar Group, its design was optimised through D-ICE's routing studies since 2018, improving sail configurations, propulsion, hull efficiency, and cargo acceleration. Canopée also integrates OCEANiCS, an advanced navigation system by D-ICE, with voyage planning, weather routing, autopilot, and real-time performance monitoring. Implemented in July 2023, the OCEANWINGS© technology completed the boat optimisation by including four automated, collapsible vertical wings, each 37 meters tall with a surface area of 363 square meters. OCEANiCS uses a high-fidelity digital twin and algorithms to optimise navigation, making it the first certified autopilot to integrate hydrodynamic and aerodynamic models compatible with OCEANWINGS©.

IMPACT ACHIEVED

Economic

- **Cut energy consumption by 15% using advanced algorithms that enhance navigation precision and fuel efficiency through autopilot and performance monitoring systems.**
- **Doubled wind propulsion performance by optimising routing and dynamically balancing hybrid sail-engine propulsion.**

Environmental

- **Reduced operational and maintenance costs by improving efficiency and lowering engine wear.**
- **Extended the lifespan of vessel components and supports long-term sustainability.**
- **Boosted situational awareness, reduced accidents and environmental risks by integrating key navigation tools.**

Social

- **Reduced crew fatigue and human error through a user-friendly interface and automated safety alarms.**
- **Increased onboard equipment usage with active crew engagement and feedback loops.**
- **Improved system performance via regular updates and new software versions based on user input.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

Recent milestones have been encouraging, positioning D-ICE Engineering for broader deployment in the coming months.

Funding secured
Raised €6 million to support ongoing technical development and innovation.

New deployment – Ponant fleet
Implementing Tactics (advanced weather routing software) across the Ponant fleet to enhance operational efficiency and safety.

New deployment – Neoliner origin
Equipping the sailing cargo ship Neoliner Origin with OCEANiCS, D-ICE's fully integrated navigation system.

Commercial expansion
Planning to scale and adapt their solutions for use on more conventional commercial vessels.

"Weather analysis and routing have become very important on ships like the Canopée, and its native interfacing inside OCEANiCS providing ECDIS and autopilot is crucial for longterm and regular use."

> Victor Depoers,
Technical Director at Zephyr & Borée

LEARN MORE HERE

bound4blue

eSAIL®

An automated wind propulsion system for ships, reducing fuel costs and emissions with autonomous operation, low maintenance, and easy installation

> COMMERCIAL SHIPPING ROUTES (GLOBAL OCEAN FREIGHT)

eSAIL® is an innovative Wind-Assisted Propulsion System (WAPS) that uses active boundary layer control through suction to harness wind energy, providing a sustainable and cost-effective alternative to traditional propulsion. It generates 6-7 times more lift than conventional sails, with low power consumption and no mechanical complexity, ensuring easy and reliable operation. Its compact design maximises aerodynamic efficiency while minimising impact on ship stability, deck space, and visibility. eSAIL® significantly reduces fuel consumption, lowers emissions, and helps ships meet environmental regulations like the EEXI and CII, ultimately leading to cost savings in both operational and capital expenditures. This technology is a game-changer for the maritime industry, combining environmental benefits with economic savings.

ESAILS® BY BOUND4BLUE ADOPTED BY LOUIS DREYFUS ARMATEURS IN FRANCE TO POWER CARGO VESSEL WITH WIND

February 2024
France

bound4blue has successfully installed three 22-meter-high eSAILs® on the Ville de Bordeaux, a ro-ro vessel owned by Louis Dreyfus Armateurs (LDA). This milestone marks the first-ever fixed suction sail installation on a ro-ro ship with a top-tier European shipowner. The installation, completed in under two days in Vigo, Spain, contributes to Airbus' objective of halving its CO_2 emissions from maritime logistics by 2030 through the transportation of the group's aircraft parts. This project highlights the potential of wind-assisted propulsion for achieving net-zero emissions by 2050. bound4blue also has agreements for further installations, including on the MV Atlantic Orchard, Odfjell's chemical tanker, and Eastern Pacific Shipping Pacific Sentinel. These installations demonstrate the growing adoption of eSAILs® to reduce fuel consumption and emissions across various vessel types.

IMPACT ACHIEVED

Economic

- **Significant reduction in fuel costs: up to 560 tonnes of fuel saved annually.**
- **Direct compliance support for IMO's Energy Efficiency Existing Ship Index and Carbon Intensity Indicator standards and reduced exposure to EU Emissions Trading System and FuelEU regulations.**
- **Quick installation and minimal operational complexity ensure fast deployment and cost efficiency.**

Environmental

- **Up to 1,800 tonnes of CO_2 emissions savings for this ship annually.**
- **Independent verification of onboard results underway with Bureau Veritas, ensuring performance credibility.**
- **Minimal ecological footprint, as the system relies solely on wind energy and clean aerodynamic design.**

"The Ville de Bordeaux installation takes us one step closer to that goal. The sails look fantastic, and we look forward to seeing them in action. Along with our client Airbus we're proud to be among the first movers in this space."

> Mathieu Muzeau, Transport & Logistic General Manager at LDA

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

The rapid deployment of eSAIL® has been powered by strategic partnerships with leading maritime players, including Odfjell, Louis Dreyfus Company, Eastern Pacific Shipping, and Marubeni. These collaborations have proven the system's adaptability across vessel types and operational profiles, and they reinforce its credibility within the global shipping community.

bound4blue is now focused on scaling up manufacturing and expanding market presence across Europe, Asia, and the Americas. Key priorities include:

Fleet decarbonisation through retrofits
Expanding retrofit programs for existing fleets to enable rapid emissions reductions without waiting for newbuild cycles.

System standardisation for scalable integration
Standardising eSAIL® integration across vessel classes and shipyards, making it a go-to solution in ship decarbonisation toolkits.

Strategic alliances for global deployment
Forming new alliances with shipowners, port authorities, and logistics operators to embed wind propulsion into decarbonisation strategies at scale.

LEARN MORE HERE

SCALING MARINE RENEWABLE TECHNOLOGY

SCALING MARINE RENEWABLE TECHNOLOGY

Unlocking the ocean's clean energy potential

As the global community races to phase out from fossil fuels, the ocean emerges as a vast and largely untapped frontier for renewable energy. Technologies such as offshore wind, wave, tidal, floating solar, and seawater-based cooling systems are poised to become central pillars of global decarbonisation, particularly in regions with limited land availability but abundant marine resources.

The potential is immense. The International Energy Agency (IEA) estimates that offshore wind alone could technically supply more than 18 times the current global electricity demand[28]. Recognising this, the Ocean Renewable Energy Action Coalition (OREAC) set a target of 1,400 GW of offshore wind capacity by 2050 to sustain a 1.5°C pathway[29].

Investment is beginning to flow. In 2023, global offshore wind investment reached a record $76.7 billion, marking a 79% increase from the previous year.[30] Projections indicate that the offshore wind industry is poised for a rebound in 2025, with capacity additions expected to reach 19 GW and sector-wide expenditure projected to hit $80 billion. This surge is catalysed by falling technology costs, long-term procurement contracts, and increasing grid integration.

Adjacent innovations are also gaining traction. Deep seawater air conditioning (SWAC) systems offer new pathways to decarbonise coastal infrastructure, from hospitals to data center, by harnessing naturally cold ocean currents. For instance, a SWAC system in Jamaica could reduce electricity usage by 92%, avoid the use of 7,300 barrels of fuel annually, and save 25.4% on air conditioning costs.[31]

However, momentum must accelerate. Achieving net-zero emissions by 2050 will require coordinated action and unprecedented scale-up. Innovative business models such as nature-based credits, energy-as-a-service, and blended finance are needed to de-risk investment and ensure these systems are not only installed but also maintained and scaled globally.

This chapter features practical examples of marine renewable solutions at work – from grid-connected floating solar farms withstanding 150 km/h winds in French ports, to modular wave energy platforms transforming breakwaters into clean power stations.

These cases highlight a key point: marine renewables are not only technically viable – they are resilient, profitable, and essential to the blue economy transition.

HelioRec
THE FLOATING SOLAR POWER PLANT

HELIOREC

A resilient floating solar power solution for oceans and nearshore waters, delivering clean electricity at half the price of the grid, without occupying land

> NEARSHORE WATERS WITH WAVES UP TO 3-4 METRES: MARINAS, PORTS, ISLANDS, LAGOONS

HelioRec designs, produces and deploys floating solar power plants (FSPPs) that harness solar energy from the surface of the sea. Its patented "hydro-lock" platform design ensures stability in wave heights of up to 3–4 metres, making it uniquely suitable for nearshore sites that experience moderate marine activity. The system is modular, cost-effective, and environmentally friendly, offering a circular, low-carbon energy alternative for ports, islands, lagoons, and coastal infrastructure where land-based solar is limited. Each installation consists of:

- A floating platform, engineered with HelioRec's patented technology and manufactured in the EU, primarily in France.
- A mooring system anchoring the unit to the seabed or shore.
- Photovoltaic (PV) components, including solar panels, inverter, and cabling, installed directly on the floating base.

Once operational, the platform generates clean electricity and offsets CO_2 emissions, all while avoiding land use conflicts, a major constraint in urban and island settings.

2023
France

BREST PORT PIONEERS FLOATING SOLAR WITH HELIOREC DEPLOYMENT

HelioRec has successfully completed the installation of a 25 kWp project at Brest Port, France, covering a total water area of 250 m². What makes this achievement particularly remarkable is that it was carried out under some of the most challenging natural conditions: Brest Port is known for its extreme tidal fluctuations, with tides reaching 7 meters, as well as powerful winds exceeding 150 km/h and intense waves.

Despite these formidable challenges, HelioRec's engineering expertise has been proven, as they designed and built a floating solar plant capable of withstanding these harsh environmental factors.

By focusing on nearshore areas, HelioRec taps into regions where conventional land-based solar installations may not be feasible due to land shortages or high real estate costs.

IMPACT ACHIEVED

Economic

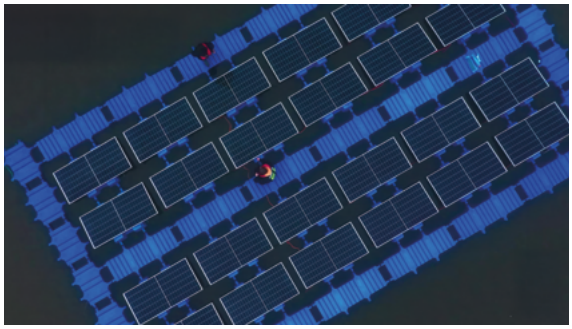
- **Delivers electricity at 112 EUR/MWh, 50% less than grid rates, enabling cost savings for energy consumers.**
- **Estimated payback period of ~12 years, with potential for acceleration as grid prices rise.**
- **Offers an affordable path to decarbonisation for ports and industrial zones under pressure to meet sustainability mandates.**

Environmental

- **Generates 18.5 MWh of renewable electricity per year, directly displacing fossil-based power.**
- **Utilises recyclable components and a low-carbon circular design to minimise lifecycle emissions.**

Social

- **Systems are locally manufactured in Brittany, stimulating regional job creation and industrial innovation.**
- **Floating systems can be combined with educational or tourism components to raise public awareness on marine renewables.**



DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

HelioRec is preparing to scale its innovative floating solar technology across Europe, with a focus on strategic partnerships and investment.

Funding

Planning a Series A round in 2025 to support large-scale deployment and commercial growth in Europe.

Partnership opportunities

Actively seeking collaborations with European ports and industrial companies interested in integrating floating solar into their sustainability and energy transition strategies.

"Together, we are working with the HelioRec team towards a sustainable future, leveraging the potential of renewable energy on the water."

> Christophe Chabert, CEO of Brest Port

LEARN MORE HERE

ECO WAVE POWER

A robust and cost-effective wave energy solution that harnesses the power of nearshore waves using infrastructure-attached floaters

> COASTAL AREAS WITH CONSISTENT WAVE ACTIVITY AND INFRASTRUCTURE ACCESS (BREAKWATERS, PIERS, HARBOR WALLS)

Eco Wave Power has developed a cost-efficient, reliable solution for generating clean electricity from nearshore and onshore waves. Its patented technology uses floaters installed on existing coastal structures like breakwaters and piers, avoiding offshore construction, mooring, seabed drilling, and underwater cables. As waves move the floaters, mechanical energy is converted into hydraulic pressure, driving a motor connected to a land-based generator. This land-attached design simplifies maintenance and lowers operational costs. Smart sensors and proprietary software optimise performance by adapting to sea conditions and lifting floaters during storms for protection. The system connects to the grid via short, land-based lines, reducing connection complexity. It is modular and scalable, ideal for both pilot sites and full-scale commercial projects.

TEL AVIV-JAFFA TURNS BREAKWATERS INTO CLEAN ENERGY INFRASTRUCTURE

Located in Tel Aviv-Yafo, the site aligns with the city's renewable energy goals and was selected for its strategic coastal position. In 2023, Eco Wave Power launched the Jaffa Port 100 kW Wave Energy Project in Tel Aviv-Yafo, in partnership with EDF Renewables IL and co-funded by the Israeli Ministry of Energy. Designed as a scalable, cost-effective alternative to fossil fuels, the project addresses energy security and complements solar and wind power. The system was installed directly on existing breakwaters, enabling a low-footprint solution with minimal marine impact. The grid connection was facilitated by the Israel Electric Company, while permitting and site access were supported by the Municipality of Tel Aviv-Jaffa, Atarim Group, and Jaffa Port Authority. This demonstration site now serves as a model for scalable, locally integrated wave energy deployment in other coastal cities worldwide.

IMPACT ACHIEVED

Economic

- **A 100 kW station can produce 175,200–350,400 kWh per year, depending on wave intensity and operational efficiency (20–40% capacity factor).**
- **Offers long-term cost-competitive electricity for local grids and on-site consumption.**
- **Generates a replicable revenue stream, reducing energy dependency in coastal zones.**

Environmental

- **A 100 kW station with 40% capacity can prevent up to 247.7 metric tonnes of CO_2 emissions annually (per US EPA equivalency tools).**
- **No underwater anchoring or mooring reduces impact on marine habitats and sediment patterns.**
- **Utilises existing coastal infrastructure, preserving seafloor ecosystems and coastal landscapes.**

Social

- **Created 5 full-time engineering positions, 1 pilot station technician, and 20+ indirect jobs in floaters production, environmental studies, and local civil works.**
- **Supported local contractors and SMEs during construction and installation phases.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

With a proven track record and growing global partnerships, Eco Wave Power is advancing toward broader deployment, greater impact, and more capital-efficient solutions to harness clean energy from the ocean.

Project expansion
Advancing projects in Port of Los Angeles (co-invested by Shell-MRE), India (in partnership with Fortune 500 company Bharat Petroleum), Taiwan (with I-KE), and Portugal, where Eco Wave Power has already begun construction on its first megawatt-scale project under a 20 MW concession agreement.

Innovation & cost efficiency
Focusing on continuous technology upgrades and reducing CAPEX to enhance scalability and competitiveness.

Investment goals
Seeking strategic investors to support global project acceleration, R&D expansion, and localised manufacturing.

Partnership opportunities
Open to collaboration with port operators, utilities, EPCs, and governments to co-develop wave energy projects and integrate into multi-use coastal platforms.

"Wave energy generation is a big challenge; the energy of the waves is beyond what the usual human construction can sustain. Therefore, it is very difficult to build something that will produce energy offshore (middle of the ocean), this is why we like the idea of Eco Wave Power." **> Ayalon Vaniche, CEO at EDF Renewables IL**

LEARN MORE HERE

PACIFIC BEACHCOMBER
FRENCH POLYNESIA

'aIRaRO

SEA WATER AIR CONDITIONING SWAC

Sea Water Air Conditioning harnesses the natural cold of deep seawater to cool buildings efficiently

> TROPICAL OR SUBTROPICAL COASTAL CITIES, RESORTS, AIRPORTS, AND DATA CENTERS

SWAC (Sea Water Air Conditioning) taps into the consistent, low-temperature water found at depths of around 900 meters (~5°C) to cool buildings using a closed-loop system. Seawater is pumped through heat exchangers that transfer its chill to a freshwater circuit used for conventional air conditioning. The deep seawater is then returned to the ocean with minimal thermal impact. This solution replaces conventional, energy-intensive AC systems, using a renewable, locally available thermal resource, cold seawater, instead of electricity from fossil fuels. It is particularly effective in tropical or subtropical coastal areas where cooling demand is high and grid emissions are substantial.

2022
French Polynesia

TAHITI HOSPITAL SETS GLOBAL PRECEDENT WITH WORLD'S LARGEST DEEP SEAWATER AIR CONDITIONING SYSTEM

In July 2022, the Centre Hospitalier de Polynésie Française (CHPF, the Tahiti Hospital) in Tahiti inaugurated the world's largest Seawater Air Conditioning (SWAC) system, a milestone in sustainable infrastructure. Planned since 2012, the $30 million project was funded by the French Development Agency, the European Investment Bank, the France Energy Transition Agency, and the French Polynesian government. The system draws seawater from 900 meters depth at ~5°C, transporting it via a 3.8 kilometers (2.36 miles) pipeline to heat exchangers that cool a closed-loop freshwater system for air conditioning, with minimal ecological impact from seawater discharge.

SWAC systems, initially implemented for hotels, have demonstrated the long-term viability of deep seawater cooling in tropical environments. The Tahiti hospital/CHPF installation, being 2.5 times larger than the earlier hotel systems, builds upon this well-established foundation.

IMPACT ACHIEVED

Economic

- **Reduced energy consumption from 9 GWh to just 0.7 GWh annually, a 93% drop.**
- **Generated over $3 million in annual electricity savings.**
- **Estimated 8-year payback period, depending on local energy tariffs and fossil fuel costs.**
- **The carbon footprint of system production is offset within the first operational year.**

Environmental

- **Prevents over 5,000 tonnes of CO_2 emissions annually, making a major contribution to local and national decarbonisation targets.**
- **Reduced dependence on imported fossil fuels, enhancing energy security in remote areas.**
- **Eliminated harmful refrigerants and heat-intensive compressors common in traditional cooling systems.**

Social

- **Improved working conditions for hospital staff and comfort levels for patients, enhancing public health outcomes.**
- **Freed up up significant operational budget, allowing hospital reinvestment in medical services.**
- **Supported local technical skill-building in SWAC operation and maintenance, creating sustainable employment pathways in energy and engineering.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

AIRARO has successfully implemented three SWAC solutions in French Polynesia, contributing at every stage of the projects. With growing recognition of its environmental and energy-saving benefits, new projects are now underway to drive the expansion of this technology beyond French Polynesia:

International expansion

Exporting the technology with new SWAC projects in the French overseas territories and in the Caribbean and Indian Ocean countries, including studies commissioned by the World Bank.

Innovation – water production

Actively developing solutions that combine SWAC with Deep Sea Reverse Osmosis (DSRO) to produce freshwater using less energy and with lower environmental impact compared to traditional osmosis processes.

Strategic partnership

Signed a partnership with FLOCEAN, a Norwegian pioneer in DSRO industrial development, to scale solutions addressing global freshwater scarcity and hydric stress, particularly for island communities.

CHPF
Centre Hospitalier de la Polynésie française

"Today, with the SWAC system, we have reduced our consumption to 700 MWh per year (vs over 9000 MWh before), which represents a drastic 93% decrease in the electricity used for air conditioning at CHPF... it's tremendous."

> Telomere Mu,
CTO at Tahiti Hospital

LEARN MORE HERE

SUSTAINABLE AQUACULTRURE AND FISHERIES

SUSTAINABLE AQUACULTURE AND FISHERIES

From exploitation to regeneration

With global demand for protein rising and wild fish stocks under unprecedented pressure, sustainable aquaculture has become not only a food security imperative, but one of the most promising frontiers in climate and ocean resilience. According to the UN Food and Agriculture Organization (FAO), aquaculture already accounts for 56% of fish consumed globally and is projected to supply two-thirds of global aquatic food consumption by 2030.[32]

Yet how we scale this industry matters enormously. Traditional aquaculture has too often come at a high ecological cost: excess nutrient discharge, habitat loss, antibiotic overuse, and dependence on wild fish for feed. These trade-offs have led to growing scrutiny of the sector, and to a clear conclusion: the status quo is not sustainable.

But a new wave of innovation is redefining what aquaculture can be.

From insect-based proteins that replace fishmeal, to precision farming that minimises waste, to regenerative ocean farms cultivating seaweed and filter-feeders like mussels and clams… solutions are emerging that decouple seafood production from environmental degradation. **These models not only protect biodiversity, they also create local jobs, stabilise coastal economies, and reduce pressure on overexploited fisheries**.

A well-managed aquaculture industry could, in fact, be one of the most resource-efficient food systems available. Farmed shellfish and seaweed require no feed, fertiliser, or freshwater, and have among the lowest greenhouse gas footprints per kilogram of edible protein.[33] Moreover, with 85–90% of global fish stocks already classified as fully exploited or overfished shifting production toward low-impact aquaculture is a vital part of any ocean recovery strategy.[34]

Investors are beginning to take note. While still a niche in global capital markets, sustainable aquaculture is attracting interest from venture funds, family offices, and institutional investors seeking long-term, climate-resilient opportunities.

This chapter highlights solutions that embody this new vision: from black soldier fly-based feed systems and AI-enabled traceability platforms to regenerative aquaculture models designed for smallholder inclusion.

Together, they prove that it's not only possible, but profitable, to produce healthy protein while restoring ocean ecosystems and building future-proof food systems.

INNOVAFEED

INSECT BASED PROTEIN

An industrial symbiosis model that turns waste into high-value feed, replacing fishmeal without compromising performance

> LARGE-SCALE INSECT FARMS NEAR AGRO-INDUSTRIAL ZONES

Innovafeed is a France-based agtech company reimagining aquaculture inputs through the industrial-scale production of **Hilucia™**, a high-performance protein derived from the Black Soldier Fly. This insect protein serves as a sustainable and effective alternative to fishmeal and soy, helping decouple aquaculture from ocean depletion and deforestation.

The solution is rooted in a **unique industrial symbiosis model**: Innovafeed co-locates its insect farms with agro-industrial sites, tapping into local energy, feedstock, and logistics infrastructure to drastically reduce emissions, optimise operating costs, and minimise waste. The result is a regional circular economy model that adds value along the entire supply chain.

A FROM WASTE TO FEED: INNOVAFEED AND BIOMAR BUILD A LOCALISED PROTEIN VALUE CHAIN FOR TROUT

BioMar, a leading company in the aquaculture industry based in Denmark, has partnered with Innovafeed since 2020 to source its Hilucia™ protein through an integrated value chain. By delivering a unique set of nutrients for fish and shrimp, the partnership promotes innovative, circular, and restorative ingredients that help reduce the reliance on forage fish which will take pressure of our oceans. This collaboration stands as a strong example of how insect-based ingredients can drive the transformation of aquaculture toward more sustainable and resilient practices.
This trout project in France marks just the beginning for the integration of insect meal in aquaculture. At this early stage of innovation, it's essential to deploy the ingredient strategically targeting high-value applications where its unique benefits can be fully leveraged. Insect meal contains active compounds such as antimicrobial peptides and lauric acid, which show strong potential to support animal health and welfare.

IMPACT ACHIEVED

Economic

- **Innovafeed is on track to double production to 15,000 tonnes per year in France within the next two years.**
- **The collaboration supports a fully regionalised value chain, increasing supply chain resilience and shortening time to market.**

Environmental

- **Displaced the need for wild-caught fish: traditional fishmeal production consumes 4+ tonnes of forage fish per tonne produced.**
- **No contribution to deforestation, unlike soy, and minimal transportation footprint thanks to local sourcing.**

Social

- **Anchored circular economic growth in rural France, revitalising areas with high agricultural waste output.**
- **Enhanced food security through local feed production and stabilised input costs.**
- **Supported sustainable aquaculture with lower exposure to global commodity volatility.**
- **Over 350 full-time jobs have been created across the entire integrated value chain, primarily in rural areas near production sites. While these roles are not tied to this single project, large-scale collaborations like the one with BioMar draw on the full range of transversal expertise.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

The next three years will be critical for the insect industry, not just to thrive, but to exist and play its role in addressing the supply security challenges of the coming decades. To succeed, Innovafeed needs the support of partners across the aquaculture industry. This means:

Production model

Doubling the current production of 7,000 tonnes within the next two years, without additional investment.

Strategic partnerships

Securing partnerships to ensure volume commitments, future sites co-developement, and accelerate cost competitiveness.

Industry collaboration

Strengthening collaborations across the value chain to amplify the benefits and adoption of insect-based ingredients, such as the "trout fed with insects" commercialisation, which has involved a collaboration with Auchan since 2020, and in the Millennial Salmon project led by Nofima alongside several aquaculture leaders to develop a shared vision for the future of aquaculture.

"Our Blue Impact concept is dedicated to advancing more sustainable feed solutions, built around three key parameters: transitioning to net zero, conserving scarce marine resources, and championing circular and restorative ingredients. Novel feed ingredients, such as Hilucia™ Protein, have the potential to play a pivotal role in achieving this vision."

> Vidar Gundersen,
Global Sustainability Director, at BioMar Group

LEARN MORE HERE

AQUANZO

THE NOMAD

A mobile Artemia production unit transforms liquid waste from the food industry into natural and essential marine ingredients for animal feed

> LAND-BASED SYSTEMS NEAR AQUACULTURE HUBS

Aquanzo is transforming marine ingredient production by farming artemia, a sustainable alternative to fishmeal, on land using agricultural liquid byproducts. Their expertise in engineering, genetics, and nutrition ensures artemia meal can match or surpass fishmeal's nutritional value and palatability. Partnering with top universities and industry leaders, they're scaling production and repurposing agricultural waste, reducing environmental impact. By pioneering farmed marine ingredients, they drive sustainable growth in aquaculture, animal feed, and human nutrition.

2024
Scotland

AQUANZO AND UK DAIRY PROCESSOR LAUNCHED A DEMONSTRATOR TO TRANSFORM LIQUID WASTE INTO SUSTAINABLE ANIMAL FEED

Aquanzo's mobile unit, housed in a 40-foot shipping container, was first deployed in August 2024 at Boortmalt, a major malt producer, to upcycle liquid co-products.

The unit was then moved in January 2025 to a large dairy facility. Based in Scotland, this global dairy processor is collaborating with Aquanzo to develop an on-site demonstrator that converts liquid waste into farmed marine ingredients for aquaculture and terrestrial animal feed.

Trials using these locally and sustainably produced ingredients in fish and poultry diets have shown that they outperform traditional fishmeal across both species.

IMPACT ACHIEVED

Economic

- **Farmed marine ingredient production can be co-located with liquid waste producers (e.g., dairy or sugarcane/ethanol facilities).**
- **These facilities generate over 2 trillion litres of nutrient-rich liquid waste annually. Upcycling this waste unlocks a new revenue stream for these industries.**

Environmental

- **The mobile unit, deployed at two facilities, has successfully upcycled 6,000 litres of various waste streams.**
- **Led to the production of over 100 kilograms of farmed marine biomass.**

Social

- **Created sustainable, locally produced protein sources, supporting rural economies.**
- **Reduced reliance on wild-caught fish, and promote circular practices within the agricultural and food industries.**

DEPLOYMENT LEVERS, ENABLERS, NEXT STEPS, AND PARTNERSHIP OPPORTUNITIES

Facility development

Planning to build a First-of-a-Kind production facility within the next 18 months to scale up operations and meet growing demand.

Sustainable impact

Aiming to establish farmed marine ingredients as a high-performing, sustainable alternative to support the growth of aquaculture and livestock feed industries.

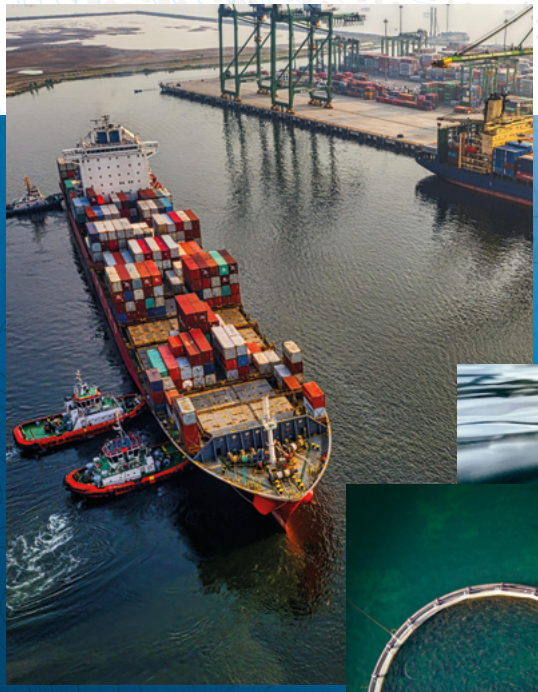
Technology expansion

Exploring opportunities to adapt and apply the technology to other major liquid co-product sources, such as sugar processing and ethanol production.

"Transforming dairy liquid coproducts from a cost into an asset would be game changing for our industry."

> David,
Director of a large
UK dairy processing facility

FINANCIAL ACTORS SPOTLIGHTS



UNLOCKING IMPACT AT SCALE

How strategic finance structures drive blue economy success

The previous chapter showcased a wave of innovative solutions ranging from sustainable aquaculture and blue carbon restoration to clean maritime logistics and data-driven ocean monitoring. But turning these promising projects into lasting, scaled impact requires more than ingenuity; it requires fit-for-purpose capital. And currently, the global financial system is ill-equipped to serve the unique needs of the ocean economy.

Despite contributing an estimated $2.5 trillion to global GDP each year – equivalent to the world's 7th largest economy –, ocean-related sectors receive less than 1% of global climate finance.

That funding gap is not just a missed opportunity; it's a systemic barrier.

The journey from pilot to scale is particularly steep in the blue economy, where risk profiles are misunderstood, timelines are longer, and success often relies on deep local engagement.

The innovations most capable of delivering ecological and economic resilience – capital-heavy, community-led, or operating in complex marine environments – often sit outside traditional investment profiles. Hardware-intensive aquaculture systems, conservation enterprises, and

Despite contributing an estimated $2.5 trillion to global GDP each year – equivalent to the world's 7th largest economy – ocean-related sectors receive less than 1% of global climate finance.

resilient marine infrastructure projects often struggle to attract finance, not because they lack potential, but because they don't fit the venture, philanthropic, or infrastructure mold. As a result, the financing available often bypasses the most promising innovation.

This chapter spotlights financial actors rewriting those rules. From open-ended aquaculture funds and growth-stage equity vehicles to self-financing marine protected areas and maritime-focused corporate venture capital, these models are not only deploying capital but reshaping how capital works.

Each of the funds and initiatives featured here is grounded in a strategic thesis and a systems-level vision: long-term partnerships, customised instruments, embedded technical support, and, above all, a clear belief that ecological and commercial outcomes can reinforce one another.

These best practices show that finance is not just a vehicle for growth. In the blue economy, finance is infrastructure: a foundational enabler of resilience, equity, and regeneration.

The following highlights offer diverse, concrete examples of how catalytic capital is unlocking scale where it's needed most.

REOCEAN FUND

Unlocking the mid-stage financing gap in ocean innovation

The ReOcean Fund, co-founded by Monaco Asset Management and the Prince Albert II of Monaco Foundation, was purpose-built to address one of the most pressing financing gaps in the blue economy: the chronic undercapitalisation of mid-stage ocean innovations. Operating under Article 9 of the Sustainable Finance Disclosure Regulation (SFRD), the fund specifically targets Series B and growth equity rounds, a segment where many promising solutions stall due to lack of catalytic capital and structured support.

What sets ReOcean apart is its dual commitment to measurable ecological impact and commercial scalability. Its core thesis is rooted in the belief that financial returns and ocean restoration are not only compatible but are mutually reinforcing. The fund supports this vision through a robust governance structure, a deep technical advisory bench, and alignment with leading frameworks such as the Ocean Impact Navigator.

"Too many promising ocean solutions struggle to grow for lack of capital at the scale-up stage. This is a missed opportunity – not just for the planet, but for investors as well. The ReOcean Fund bridges this gap by supporting companies ready to scale their impact and their business. We believe this is where meaningful results and returns align most."

> Romain Ciarlet,
Executive Director, Prince Albert II of Monaco Foundation

The fund's impact targets are as ambitious as its portfolio: reducing ocean pollution, scaling regenerative blue food systems, decarbonising shipping, and restoring marine ecosystems.

ReOcean aims to deploy 80% of its capital into established, high-impact companies with demonstrated commercial traction, such as NatureMetrics (biodiversity eDNA analytics). All investee companies are already transforming their respective markets, often acting as industry-first movers with proprietary IP, global clients, and measurable environmental results.

The fund also leverages Monaco's growing blue innovation ecosystem as a platform for piloting, scaling, and visibility, turning the principality into a "living lab" for ocean impact.

The fund's impact targets are as ambitious as its portfolio: reducing ocean pollution, scaling regenerative blue food systems, decarbonising shipping, and restoring marine ecosystems. With a total target size of €100 million, ReOcean expects to make 12–15 primary investments (ticket sizes of €3–5M), complemented by early-stage bets (20% of capital) and follow-on support to enable scale-up or acquisition-readiness.

ReOcean's innovation lies not only in what it funds, but how. By aligning philanthropic capital, scientific expertise, and private equity tools under one vehicle, it demonstrates a new blueprint for ocean impact investing: one that balances credibility with scale, and science with capital discipline.

tidal

TIDAL VENTURES

A targeted approach to maritime decarbonisation – led by industry, powered by startups

Forget the romantic image of a ship sailing toward the sunset: today's maritime sector is a $14 trillion economic backbone that transports approximately 80% of global trade. This share is expected to grow by 40–115% by 2050.

With a global fleet of 110,000 vessels valued at €2 trillion, and 40% of port cargo tied to fossil energy, the stakes are high: an estimated €4 trillion must be invested over the next decade to decarbonise maritime transport and port operations.

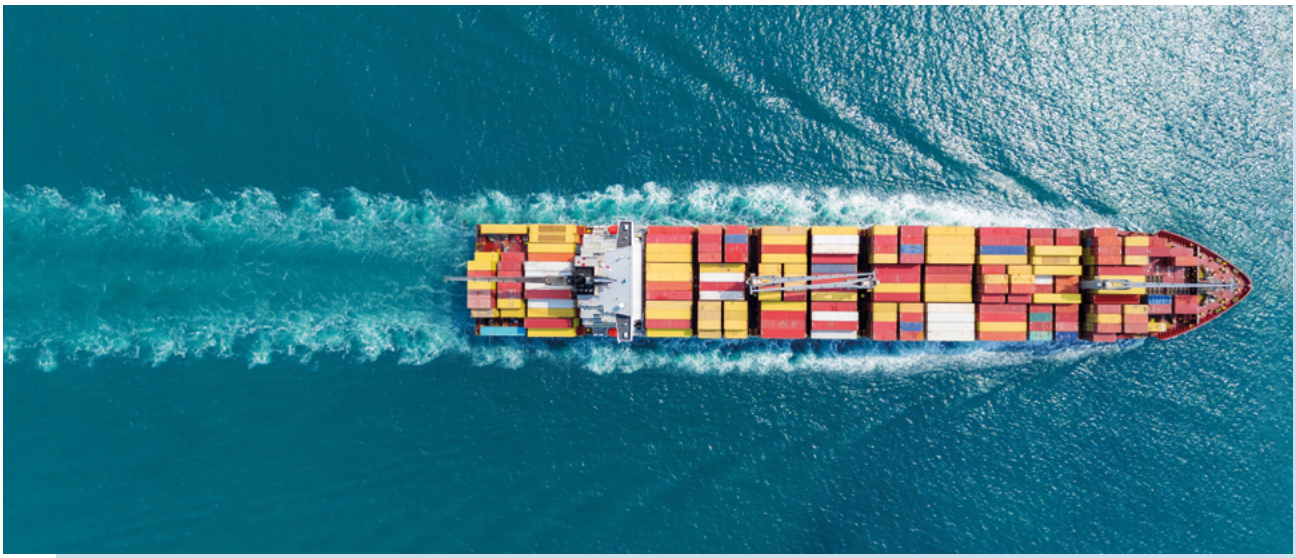
This transition is not only essential, it is inevitable. As 40% of all shipped cargo are fuels, transitioning from fossil to clean over the next decades. These trends are now underpinned by regulatory force: from the International Maritime Organization's decarbonisation strategy to the EU's FuelEU Maritime and ETS mechanisms, a level playing field is finally emerging for low-emission technologies.

Big numbers, big opportunities... but a striking lack of venture capital.

Despite Europe's deep maritime heritage, home to 40% of the global fleet, the world's top offshore companies, and leading maritime research centres, industrial VC investment in this space remains scarce. Startups can raise small amounts from grants, accelerators, and family capital, but a financing gap persists for ventures needing €2–10 million: too advanced for early-stage investors, yet still too risky or complex for generalist growth capital.

"Our industry is faced with a variety of challenges. Although we are at the forefront of the energy transition, some crucial solutions will come from startups and scale-ups we don't know yet. Ninepointfive Tidal's investment approach brings together like minded stakeholders, allowing them to focus on their core business with front row seats to the tech needed."

> Alexander Saverys,
CEO at CMB. Tech



Hardware-first, industry-embedded venture capital.

The challenge is not just capital scarcity – it's a mismatch of models. Most VC today is optimised for digital platforms, yet the maritime energy transition is about molecules and mechanics: green fuels, electrification, wind propulsion, engine innovation, offshore installation and data-driven automation. While digitalisation can deliver 20–25% emissions savings, the remaining 75% requires transformative physical systems.

This is where Tidal steps in. As a vertically focused, corporate-backed venture platform, Tidal invests in both digital and hardware solutions tailored to the complexity of maritime, ports, and offshore. **It bridges technical and knowledge gaps by aligning startups with experienced industrial players, creating real-world pathways for scale-up and bankability.**

Three key principles underpin Tidal's model:

- **Industry-rooted partnerships:** The maritime sector is governed by engineering constraints, regulatory frameworks, and environmental risk. Tidal builds syndicates of startups and corporates, enabling faster product-market fit, deployment pilots, and tech adoption. For corporates, it's a front-row seat to emerging innovation; for startups, it's access to scale, credibility, and operational support.
- **Blended value creation:** Tidal enables corporates to invest for both financial and strategic return, while startups retain independence and maximise value in an industry-embedded context. The platform is also attractive to financial investors who may lack sector expertise but seek exposure to climate-relevant infrastructure innovation.
- **Focus on capital-heavy solutions:** Ships will still sail on fossil fuels for some time – but every incremental gain in fuel efficiency, electrification, or clean propulsion matters. Tidal provides patient venture capital and fast scalability support for hardware ventures until their solutions become bankable. In doing so, it revives the original purpose of venture capital: de-risking new technologies to the point where commercial finance can take over.

By combining corporate partnerships with climate impact and strong industrial know-how, Tidal enables investors to back infrastructure-scale innovation in one of the world's most complex, yet impactful, sectors.

THE OCTOPUS PLATFORM

THE OCTOPUS PLATFORM

Streamlining investment into the regenerative blue economy

Set to launch at the 2025 Blue Economy and Finance Forum in Monaco, The Octopus Platform is a new public-good digital infrastructure designed to bridge the ocean finance gap. It brings together complementary tools and initiatives under a unified architecture to connect investors, innovators, scientists, and policy leaders around the shared goal of financing a sustainable, regenerative and sustainable blue economy.

The platform integrates two core initiatives:

- **The Octopus Desk,** a blue finance matchmaking tool co-developed by the Ocean Risk and Resilience Action Alliance (ORRAA) and Salesforce, powered by AI and built to align investor profiles with bankable blue economy projects.
- **Pelagora,** a cross-asset investment storytelling engine designed to translate scientific evidence and real-world experience into actionable insights for institutional and retail investors. Pelagora is led by a coalition including 2050, Waves of Change, Vibrant Data Labs, and the Stockholm Resilience Centre.

Set up as a 360° ecosystem, The Octopus Platform:

- **Grounds financial decision-making in science and datab;**
- **Inspires investors through blue finance pioneers' stories;**
- **Matches investors with actionable, scalable projects, using AI;**
- **Showcases practical case studies across all asset classes;**
- **Tracks financial flows and identifies funding gaps to inform future capital allocation.**

Acting as an enabler to drive more capital into the regenerative blue economy, the platform inspires and equips financial actors – and traditional capital providers in particular – with the capacity and understanding necessary to guide their decisions. Featured blue financial instruments span equity, venture capital, debt (blue bonds and loans, debt for nature swaps), blue carbon / biodiversity credits, as well as blended finance approaches.

One example is the **Blue Alliance x BNP Paribas Impact Loan Facility**, also profiled below in this guide. This case, which also includes an innovative parametric insurance coverage by AXA Climate, illustrates how tools like **The Octopus Platform** can help mainstream complex, multi-actor finance models by making them easier to find, understand, replicate, and support. As **Pauline Blandin Lecoq**, Investment Director for Impact Investment at BNP Paribas Asset Management, put it:

"The partnership with Blue Alliance marks a milestone in BNP Paribas' support to marine ecosystems protection and restoration. We hope that other investors will join this innovative impact debt facility to scale up private financing supporting Blue Alliance's MPA management across new areas. The Octopus Platform not only provides a showcase for this achievement, but also the tools and inspiration needed to facilitate this type of operation in the future for investors looking to finance a regenerative blue economy."

Looking ahead, The Octopus Platform aims to scale its impact through strategic partnerships, regional deployments, and ongoing integration of user feedback, **making blue finance more discoverable, actionable, and transparent for all stakeholders.**

Blue Alliance
MARINE PROTECTED AREAS

BLUE ALLIANCE

Marine Protected Areas (MPAs) that finance themselves

As the global community accelerates efforts to protect 30% of the ocean by 2030, Blue Alliance offers one of the most innovative and credible models to do so by combining large-scale marine conservation with financial self-reliance, ecological regeneration and community-led development.

By 2040, the Alliance, with strategic partners, aims to co-manage 70 million hectares of Marine Protected Areas (MPAs) across 14 countries, encompassing 25% of the world's coral reefs. At the core of its approach is a belief that marine conservation must be both ecologically effective and financially sustainable for communities, and that lasting protection can only be achieved when MPAs generate their own revenue.

To that end, Blue Alliance supports each MPA through a portfolio of reef-positive enterprises, locally rooted businesses such as community-based aquaculture, sustainable fishery, ecotourism and blue carbon ventures. These businesses are designed not only to reduce environmental pressure on marine ecosystems, but also to generate stable income streams to finance conservation activities and bolster local livelihoods.

"The Reef Positive Business initiative is expected to bring significant benefits to the local community. One of the primary impacts will be the creation of employment opportunities, particularly in the areas of sea cucumber farming, reef monitoring, and associated support services. This will enhance livelihoods and economic stability for community members. Additionally, by designating a specific area for sea cucumber farming that will be permanently closed to other forms of fishing, the project will contribute to the regeneration and sustainability of marine life. Over time, this protected area will support the recovery of fish populations, ultimately benefiting the broader marine ecosystem and supporting long-term food security for the community."

> **Suleiman Kombo Ali,**
MPA Manager at Blue Alliance PECCA

To implement this model at scale, Blue Alliance's versatile blended finance vehicle for MPAs combines grants, refundable grants, performance impact loans, and climate insurance solutions. Grants are used to manage MPAs until they can be gradually funded by income from reef-positive businesses. Refundable grants and impact loans provide initial working capital and equipment for these businesses. Impact loans are distributed through an impact loan facility, launched with initial commitments from BNP Paribas and incubated by the UBS Optimus Foundation. Axa Climate – with the support of Humanity Insured – is providing climate insurance that has been designed to mitigate major climate event risks for the MPA networks and reef-positive businesses.

This strategy is already bearing fruit in Belize, Indonesia, the Philippines, and Tanzania, where Blue Alliance is scaling its first phase: the co-management of 9 million hectares of MPAs by 2030.

Each MPA operates under long-term delegated mandates from national governments, with enforcement and legal authority retained by the state.

To expand from 1.7 million to 9 million hectares, Blue Alliance has outlined a $46 million blended finance roadmap:

- **$13 million in concessional debt;**
- **$8 million in performance-linked repayable grants;**
- **$25 million in non-repayable catalytic grants.**

This capital will finance:

- **70+ activities per MPA: conservation, ecosystem monitoring, local governance, and community development;**
- **Scale up a portfolio of 15 bankable reef-positive businesses (RPBs) each designed to both reduce ecosystem degradation and deliver long-term income for MPA operations through dividends.**

By 2040, Blue Alliance's ambition is to scale its model to 70 million hectares of MPAs, focusing on the most critical coral reef ecosystems in the Global South. **This long-term vision positions Blue Alliance as a leading actor in next-generation ocean finance, not simply as a conservation implementer, but as a system architect, proving that MPAs can move beyond grant dependency to become resilient, community-driven engines for biodiversity protection, climate adaptation and inclusive economic growth.**

AQUA-SPARK

The world's largest sustainable aquaculture investment fund: rethinking time horizons and value chains

Founded and based in the Netherlands, Aqua-Spark is the first global investment fund (active since 2015) fully dedicated to transforming aquaculture into a sustainable industry. With over €270 million raised and a portfolio of 22 companies worldwide, the fund takes a systems-level view of aquaculture investing across the entire value chain, from sustainable feed ingredients and disease management to traceability tech and regenerative production of seaweed and clams. By investing across the value chain within a single sector, Aqua-Spark is able to explore inter-company synergies as its portfolio grows and matures.

Its investment thesis is underpinned by long-term commitments, capex intensive investments and patient capital.

Unlike traditional VC structures with predefined exits, Aqua-Spark is an open-ended fund, which allows it to support capital-intensive businesses through multiple growth phases: from pilot to commercial scale to industrial deployment. **This is particularly critical for driving positive change in aquaculture, where infrastructure buildout (such as large-scale production or feed plants) can take over 10 years to reach profitability.**

"As a developer and producer of innovative feed solutions, primarily focused on aquaculture, our relationship with Aqua-Spark, an impact investor with deep industry expertise and a broad network has been of tremendous value to Calysta. Aqua-Spark's ability to focus and support long term has been absolutely critical to our company."

> Alan Shaw,
Alan Shaw, CEO at Calysta, Aqua-Spark Portfolio Company

After supporting the company in its early days, Calysta is now producing and selling from its commercial plant, which has an annual capacity of 20,000 tonnes.

The fund typically takes minority but significant stakes in portfolio companies and actively supports follow-on funding rounds, remaining actively involved well beyond the initial investment.

For instance, Aqua-Spark's backing of Calysta (initial investment made in 2015), a company producing alternative protein through microbial fermentation of methane, highlights this trajectory. After supporting the company in its early days, Calysta is now producing and selling from its commercial plant, which has an annual capacity of 20,000 tonnes. Next steps include continued global expansion through strategic locations and partnerships. New production facilities could reach capacities of up to 100,000 tonnes, unlocking projected annual revenues in the several hundred million range. Calysta's product 'Feedkind' offers a sustainable alternative protein to fishmeal. Traditional fishmeal and fish oil production account for approximately 20% of global fish catch and have a significant impact on ocean health and biodiversity.

Beyond capital, Aqua-Spark brings deep sectoral knowledge and alignment with ocean conservation goals. The fund's founders, Mike Velings and Amy Novogratz, are driven by a passion for marine health and entrepreneurial ecosystems. As of today, Aqua-Spark continues to expand its platform with thematic funds and partnerships, proving that a patient, ecosystem-focused financial model can unlock both commercial success and environmental transformation in ocean food systems.

BNP PARIBAS

BNP PARIBAS

Catalysing decarbonisation and biodiversity through ocean finance

As one of Europe's leading financial institutions, BNP Paribas is embedding ocean preservation into the core of its sustainable finance strategy. The Group was among the first global banks to publish, in 2019, a dedicated public Position on Ocean Protection. This statement laid the groundwork for a long-term commitment to ocean preservation, reinforcing the Group's contribution to the United Nations' Sustainable Development Goal 14 (Life Below Water).

Today, BNP Paribas supports the transition to a sustainable blue economy across three strategic fronts:

- **Supporting corporate transformation by helping clients decarbonise operations, particularly in ocean-reliant sectors like shipping;**
- **Developing specialised financial instruments that channel capital toward marine ecosystem preservation;**
- **Backing innovation and scientific research through partnerships with startups and ocean science institutions.**

In the maritime sector, which represents approximately 3% of global GHG emissions, BNP Paribas has already mobilised over €1 billion to finance the ecological transition of ships. **Among the ventures supported is Bluefins, a French deep-tech company developing a biomimetic hydrofoil propulsion system inspired by whale tails. Installed on the stern of a vessel, the system transforms wave energy and hull motion into forward thrust, cutting fuel consumption and emissions by up to 20%.** Its modular design and real-time optimisation software enable retrofit at scale, positioning it as a powerful solution for short-term maritime decarbonisation.

"Bluefins offers a pragmatic, high-impact solution to one of ocean shipping's most urgent challenges: decarbonisation. By retrofitting vessels with our biomimetic, whale-inspired hydrofoil system, shipowners can reduce fuel consumption and emissions by up to 20%, with a return on investment in under three years. Our technology is engineered for operational simplicity, real-world performance, and large-scale impact. We are proud to share this solution with the Solar Impulse Foundation and to join a community of pioneers driving scalable change across industries."

> Philippe Ruffin,
CEO at Bluefins

Beyond supporting startups, BNP Paribas is helping create new financing structures that channel capital directly to marine ecosystem protection. In October 2024, it partnered with Blue Alliance to launch the Blue Finance Facility, an innovative impact loan vehicle designed to finance community-led preservation of Marine Protected Areas (MPAs) in developing countries. The facility relies on concessional capital at Blue Alliance level in order to de-risk and attract private capital for local enterprises that protect coral ecosystems while generating sustainable revenue.

The Group is also supporting research through philanthropy: in January 2025, the BNP Paribas Foundation launched a new call for projects as part of its Climate & Biodiversity Initiative, bestowing €7 million to fund marine and coastal ecosystem research. This edition was awarded the "Ocean Decade" label by the UNESCO Intergovernmental Oceanographic Commission.

Put together, these various endeavors illustrate how financial actors can play a direct role in scaling marine conservation, supporting innovation and research, and decarbonising ocean industries: not in the distant future, but today.

AXA Climate

AXA CLIMATE

Fast-acting coral insurance to safeguard the Mesoamerican Reef

Along the coast of Central America, the Mesoamerican Reef – the second-largest barrier reef in the world – is facing increased threats from tropical storms and hurricanes.

In response, AXA Climate has helped pioneer one of the world's first coral insurance mechanisms, offering parametric coverage designed to ensure a swift and effective response after extreme weather events. This innovative approach aims to protect one of the most biodiverse ecosystems on Earth while supporting local conservation efforts.

The purpose of the insurance is to ensure rapid reef restoration following hurricanes.

The parametric insurance policy, underwritten by AXA Climate and placed by WTW, has been designed specifically to enable rapid reef response following a hurricane. This ensures that emergency actions – such as clearing debris, rescuing broken coral fragments, and initiating restoration – can begin immediately, minimising long-term damage. Originally covering just four coral reef sites, the program now protects ten critical locations across the region.

"The goal is to secure the long-term viability of coral conservation initiatives. By enabling immediate action post-disaster, we protect not only the reef ecosystem but also the communities and economies that depend on it."

> Ariane Kaploun,
Nature-Based Solution Expert at AXA Climate

The insurance is structured to benefit local conservation actors directly.

The client under the policy is MAR Fund, a regional environmental trust fund that supports reef protection in Belize, Guatemala, Honduras, and Mexico. MAR Fund became AXA Climate's first nature-based client in the Caribbean. The insurance was first issued in 2021 and, following successful implementation and growing interest, has been renewed annually with expanded geographic coverage through 2024. TASA, a local NGO, is responsible for executing coral restoration interventions on the ground.

The policy delivered its first payment just days after Hurricane Lisa.

On November 1, 2022, the Prime Minister of Belize declared a hurricane warning for the nation's entire coastline. Just two days later, Hurricane Lisa made landfall south of Belize City as a Category 1 storm, directly impacting the reef. By midnight, the national emergency organisation issued an "all clear" signal, and less than a week later, the payout was triggered.

AXA Climate processed the payment on November 9, and within 10 days of the storm, $175,000 had reached MAR Fund to finance emergency coral restoration, $87,000 of which came directly from AXA. This rapid disbursement demonstrated the effectiveness of parametric insurance in nature protection, reducing delays often seen in traditional indemnity models.

This innovative insurance solution was made possible through the collaboration of key partners including AXA Climate, MAR Fund, Munich Re, the InsuResilience Solutions Fund, WTW, and TASA. Together, they are redefining how insurance can be used as a tool not just for financial recovery, but also for ecological resilience.

By bringing together science, local expertise, and financial innovation, the Mesoamerican Reef insurance initiative stands as a replicable model for protecting nature through insurance – one reef at a time.

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