cordap

G20 Coral Research & Development Accelerator Platform

Ecosystem Scouting

Engaging Industry in Coral Restoration, a Global Landscape

Identifying and mapping the global industry landscape to identify businesses and technologies which could partner with the coral community to scale up, produce and implement affordable solutions for conservation and restoration.

Outsmart
Insight

Contents

Foreword

The world's coral reefs, often called the 'rainforests of the sea', are among the most biodiverse ecosystems on the planet, providing critical habitat for a significant portion of marine species, protecting coastlines from erosion, and supporting the livelihoods of hundreds of millions of people globally.Yet, these vibrant ecosystems are under unprecedented threat due to climate change, pollution, overfishing, and other human activities. The urgency of coral conservation and restoration has never been more pronounced.

As we confront this crisis, it is clear that we must come together to address the scale of the challenges we face, scientific research and development can only provide a part of the overall solution. To truly make a difference, we must engage the ingenuity, resources, and capabilities of industry. We need to bring their eyes and thinking to the challenge to unlock options that scientists have not yet considered. This report seeks to map the intersection of relevant industries and companies with technologies and solutions that are applicable to coral restoration and conservation. By identifying the key players and innovations, we can illuminate pathways to collaboration that are crucial for scaling up efforts and making them accessible to those who need them most.

The importance of engaging industry cannot be overstated. The private sector has a unique ability to drive innovation, bring solutions to market, and achieve the efficiencies needed to make new technologies both scalable and affordable. From biotech firms helping to develop resilient coral strains to engineering companies automating processes, and from tech giants using AI to monitor reef health to material scientists creating sustainable reef building materials—these industries have a vital role to play in the future of coral conservation.

This initial report is a call to action. It highlights the necessity of forging partnerships across sectors, fostering innovation, and creating synergies between science and industry. The solutions to the coral crisis must be both cutting-edge and pragmatic, scalable yet sustainable, and above all, accessible to the communities on the front lines of this environmental battle.

As we navigate the complex and urgent task of saving our coral reefs, it is our hope that this report, which is a starting point only, serves as a valuable resource for stakeholders across sectors. By working together, we can develop the technologies and solutions necessary to protect and restore these irreplaceable ecosystems for future generations.

David Mead
Chair, CORDAP Scientific Advisory Committee

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GRoW Oyster Reefs

The G20 Coral Research & Development Accelerator Platform (CORDAP, cordap.org) is a global initiative designed to fast-track innovative research and solutions aimed at safeguarding and restoring coral ecosystems. Established in response to the escalating threats faced by coral reefs due to climate change, pollution, and other human-induced factors, CORDAP unites governments, scientists, practitioners and industry to promote cutting-edge R&D. Resourced through voluntary contributions to support collaboration and funding breakthrough technologies, CORDAP seeks to enhance coral reef resilience and ensure their survival for future generations. The platform is particularly focused on solutions tailored to developing countries and vulnerable regions.

What's the landscape

Coral reefs are home to a quarter of all marine species, despite covering less than 0.1% of the ocean – but they are under threat and time is short. Addressing this global challenge, requires scalable, innovative, and collaborative responses – the bedrock of which will be technology.

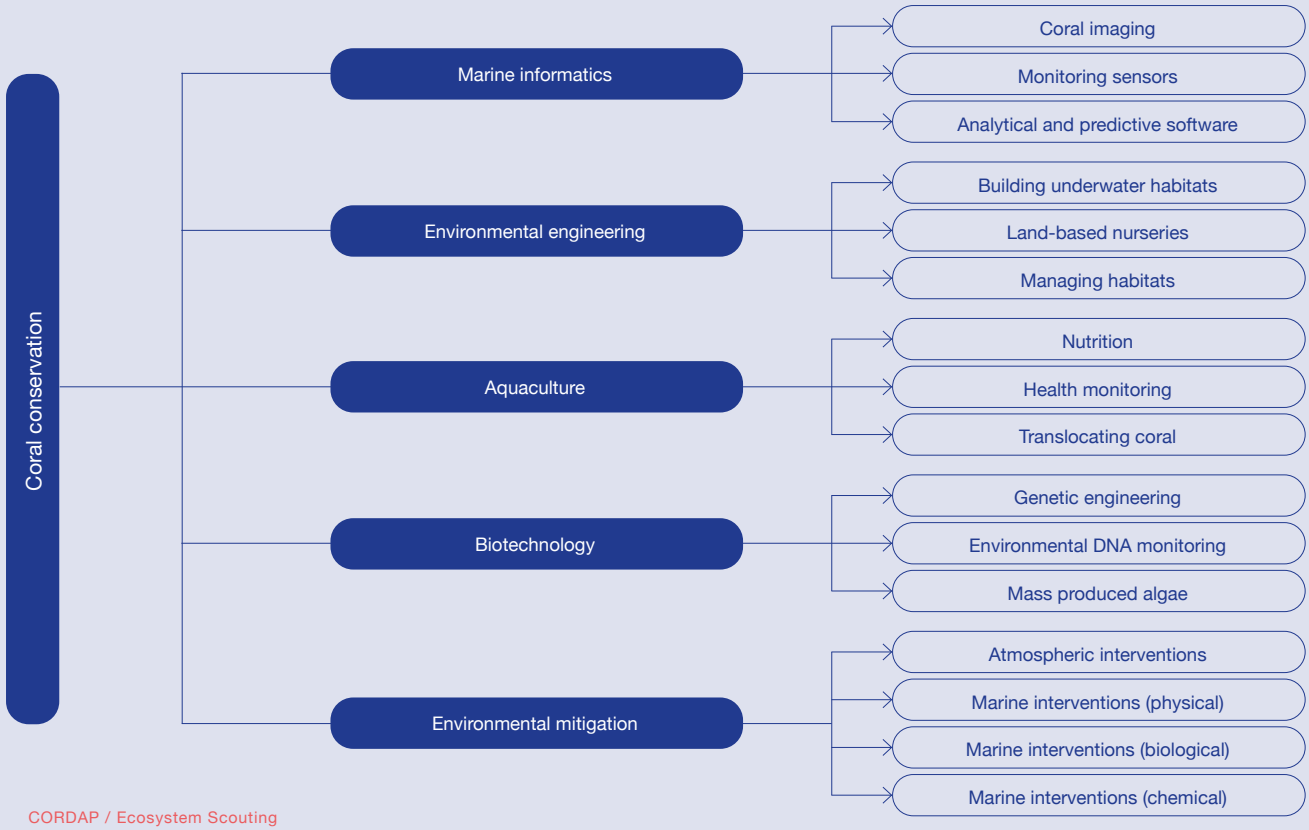
Restoration efforts are typically community-led, small in scope, and difficult to scale due to a lack of economic incentives. The research, development and innovation ecosystem is primarily supported by grants, charity funding, local tourism initiatives, and corporate programmes. With the ecosystem currently comprising multiple small players, partnering with larger organisations that can bring expertise and resources from other sectors offers a route to scalability.

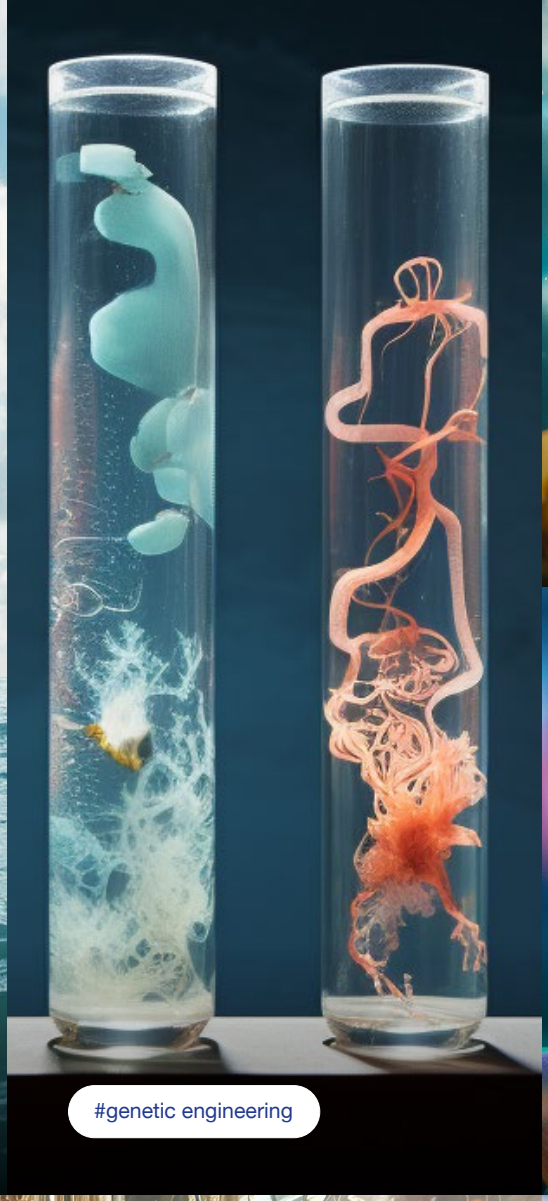
For this study, over 200 private sector players were mapped across both coral-specific and adjacent industries. While some are directly applying their technology to corals, the majority are targeting commercially driven activities such as aquaculture but offer crossover potential.

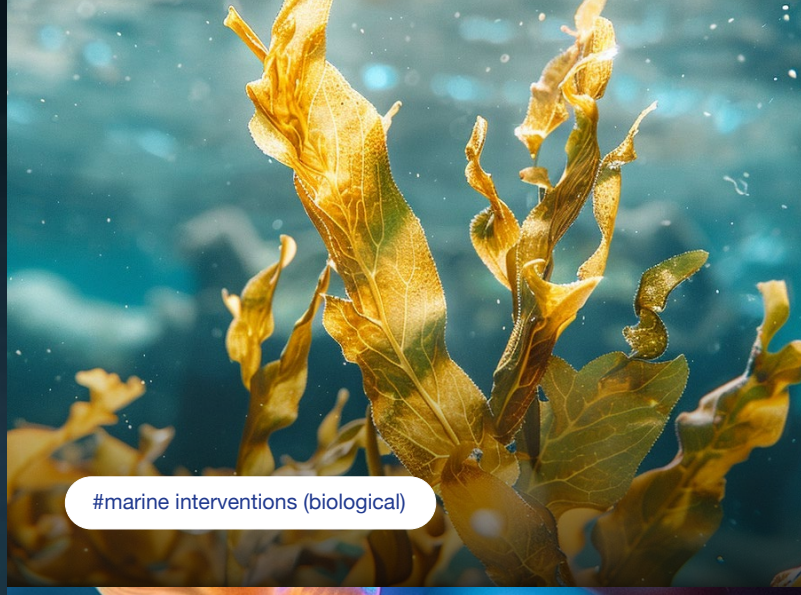
Prevailing conservation approaches include building artificial reefs and habitats, as well as deploying sensors to monitor water quality or contamination. The varied strategies and approaches are organised in a framework.

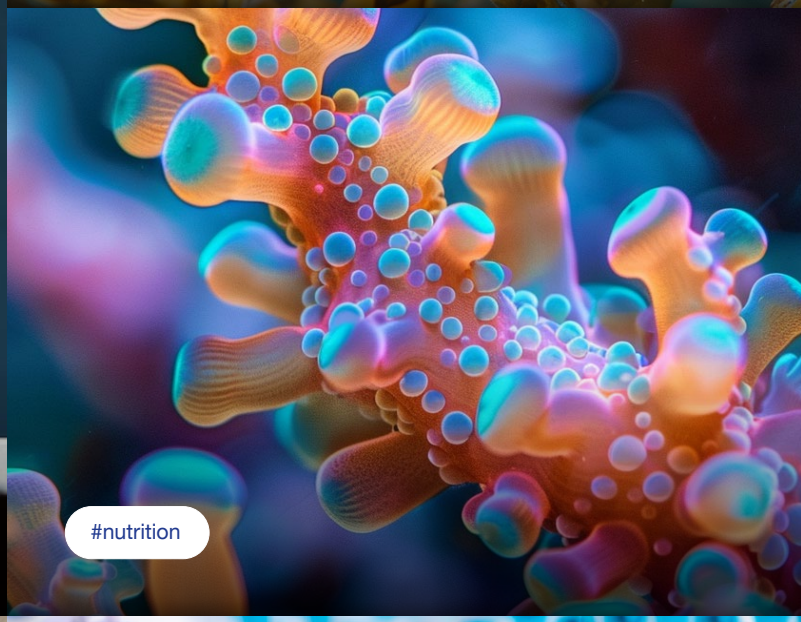
In addition, deep and cold-water corals (CWC) form globally significant, yet understudied and poorly understood, diverse productive ecosystems, providing significant functions in the deep sea, such as habitat and nursery grounds for other species including commercially valuable fish and crustacean species. The remote nature of these ecosystems means that accessing them is a difficult and expensive task, and one that technology can make a huge difference in, making industry partnerships a real imperative.

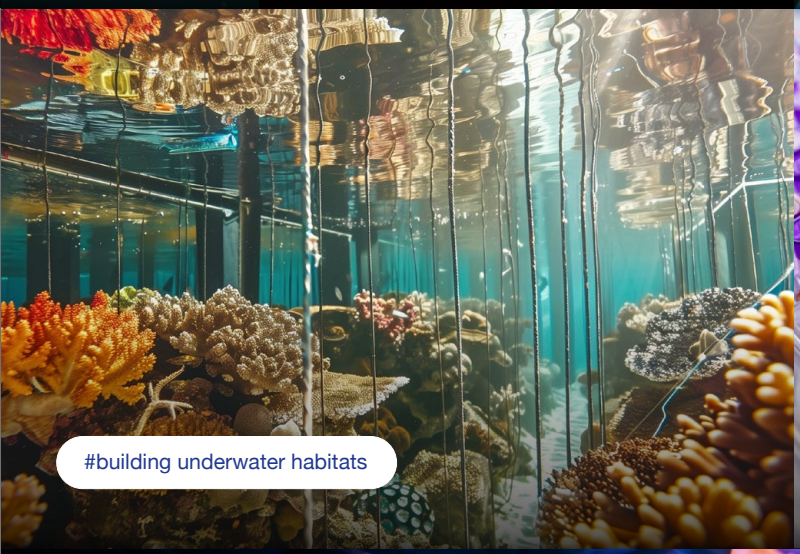
Taxonomy: Salient strategies and approaches being developed for coral conservation



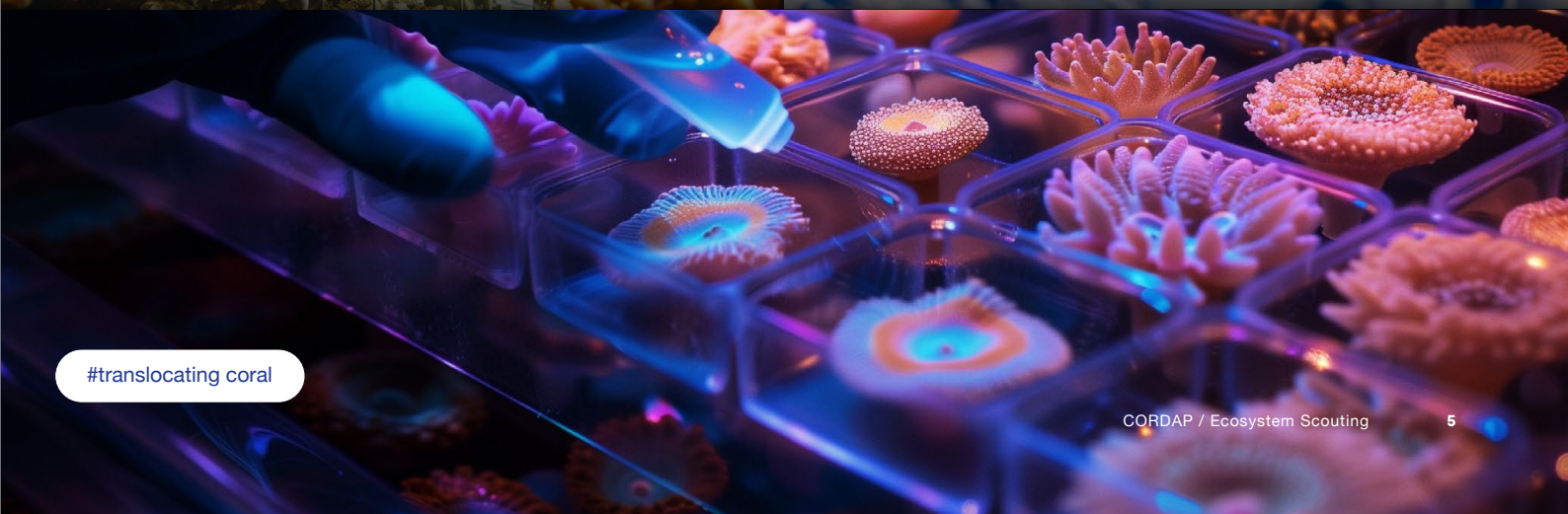

#genetic engineering


#marine interventions (biological)


#nutrition

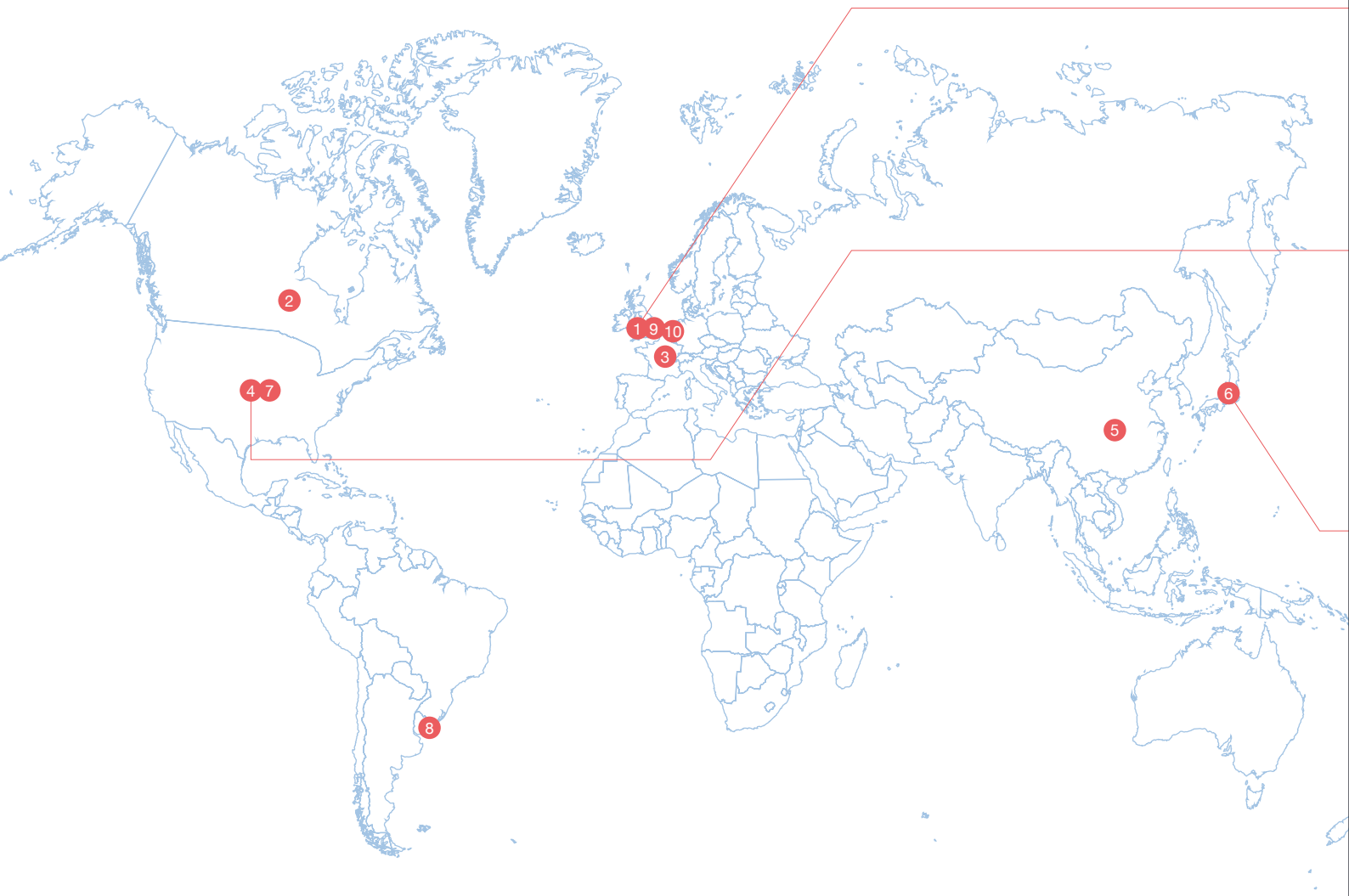

#building underwater habitats


#eDNA monitoring


#translocating coral

Spotlight on industry players who could support coral conservation and habitat restoration

Featured companies primarily operating outside the coral space that are developing technologies with crossover potential for coral conservation.



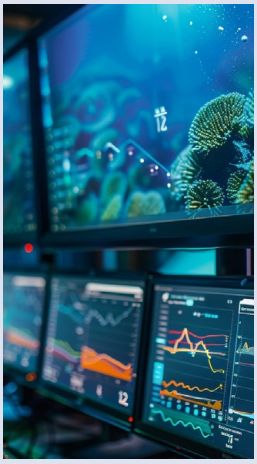
When dealing with such a global challenge, it is important to look outside existing solutions, to obtain diversity in technology, opinions, and outlooks.

Outside of coral-centric businesses, areas such as fish aquaculture, agriculture and even construction offer transferable technologies that could be applied to coral conservation. Established providers with existing resources and revenue streams may be able to efficiently contribute to comprehensive restoration efforts by leveraging their industrial-scale facilities and capabilities. Partnering with an existing player and therefore an existing product offering can overcome a key hurdle for projects that are currently restricted by scale or funding. It may be that the business case for engagement with conservation, existing or potential, could be fueled by social responsibility concerns or by seeing the endeavour as profitable.

The map features a number of globally distributed companies in adjacent sectors but with potential crossover technologies that could facilitate coral conservation. Many players are already contributing to small-scale coral-based projects, illustrating a willingness to engage with conservation projects. Also included are companies with significant production capabilities that could help scale up reef-restoration technologies, thus making them more affordable.

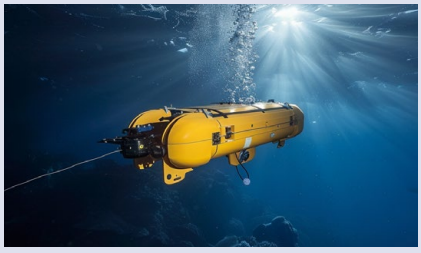
1 BMT Group (UK)

Maritime-oriented technical consulting firm formed in 1985. A 2019 project in the Great Barrier Reef extracted coral from the sea bed and placed it into biodegradable nets, providing a base for coral recruitment. *Appendix: ID 120*



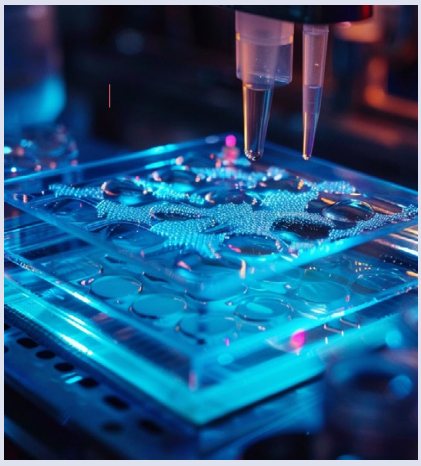
2 AquaSignum (Canada)

Provides insight into aquatic environments with real-time microbial monitoring via sensors. The sensors could contribute to the early detection of coral stress or disease outbreaks, allowing for timely intervention. *Appendix: ID 93*



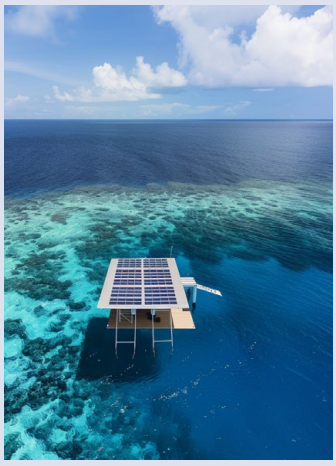
3 Exail (France)

Produces autonomous underwater platforms traditionally used for marine pipeline inspection and seabed mapping. The technology could be used to image coral reefs for health monitoring. *Appendix: ID 72*



4 Metabolon (US)

A leader in metabolomics research aimed at the life sciences and drug development industries. While not carried out by Metabolon, NIST (National Institute of Standards and Technology, US) researchers have used metabolomics to understand the mechanisms driving growth anomalies in coral disease. *Appendix: ID 147*



5 Huawei / Tech4Nature (China)]

telecommunications company that has developed solar-powered surface platforms and underwater sensors to measure environmental conditions and coral growth in coral nurseries at different depths. *Appendix: ID 97*

6 Kajima Corporation (Japan)

One of the oldest and largest construction corporations in Japan. It manufactures a biodegradable net that can be placed on the seafloor and facilitate coral growth as it takes root. *Appendix: ID 36*

7 Autodesk (US)

An industrial design software company, developing AI-powered robots to assist with coral skeleton seeding. In partnership with CoralMaker, robots are being deployed at land-based nurseries or on boats at restoration sites, and divers or AUVs will then translocate the corals to areas in need. *Appendix: ID 119*

8 Satellogic (Uruguay)

Designs and operates small satellites to provide high-resolution imagery and data analytics. This could provide a means of quantifying health and damage across ecosystems worldwide. *Appendix: ID 86*

9 Oxford Nanopore Technologies (UK)

Focusses on using nanopores for the real-time analysis of DNA, RNA, and proteins. Characterisation of coral holobionts could allow reef-scale network analysis of associated bacteria. *Appendix: ID 131*

10 Fugro (Netherlands)

A large geotechnical, geodata and geosurvey company, providing a range of remote and autonomous underwater vehicles (AUVs), which can be equipped with a range of advanced sensors, and AI-powered systems for automated monitoring. *Appendix: ID 96*

Applied Genomics

Applied Genomics offers environmental DNA (eDNA) sampling and analytics enabling customers to monitor biodiversity and identify species. This enables both water quality and the impact of offshore marine structures, assets, and infrastructure on marine ecology to be quantified. It claims to be the only company enabling large volume eDNA analysis.

Technology Overview

Conventional eDNA sampling techniques involve passing water through a filter. However, the results of this analysis are dependent on the direction of current flow. Deploying its larger, custom-made eDNA samplers for at least a full tidal cycle is more representative.

Once the sampled water has been returned to the lab, Applied Genomics utilises quantitative polymerase chain reaction (qPCR) sequencing to detect targeted species. Furthermore, long-read sequencing is deployed to enable DNA metabarcoding to determine species composition.

Applied Genomics' measurement capabilities have already been used to sample marine sediment in and around artificial reef structures. For example, an eDNA study off the UK coast detected a 217% increase in species richness following the installation of an artificial reef structure, with 132 sedimentary species exhibiting significant increases in population genetic diversity.

Cross-over potential to corals

eDNA sampling and analysis can be used to monitor species biodiversity and genetic material, offering insights into population structure and migration patterns. Corresponding genetic markers indicate presence and abundance in reefs and can be applied to assessing the impact of interventions. Pollution and presence of invasive species can be demonstrated.

Scalability

Applied Genomics builds its eDNA samplers (called inDEPTH) in-house, lending to customers for sample acquisition. Ultimately, customers purchase an integrated solution of sampler rental and analysis to produce data sets that can then be queried. Scalability is limited in the short term by the number of samplers that can be deployed, as well as by sampler manufacturing and laboratory capacity.

Location	UK
Employees	1-9
Maturity	Startup
Founded	2014
Funding	Revenue funded growth

Target Markets
Aquaculture, offshore oil and gas, offshore renewables, ports and shipping, agriculture, forestry

Partnerships & Customers
Plymouth Marine Laboratory, NEOM

Taxonomy Tags

#biotechnology #eDNA monitoring

Sebastian Mynott
General Manager & Founder,
Applied Genomics

Sebastian has nearly two decades of experience in ecological surveys, geospatial analyses, and numerical modelling. For the past decade, his focus has been on developing eDNA sampling and analysis methodologies for biodiversity monitoring and reporting.

Using large volume eDNA samplers, like Applied Genomics, in a very high biodiversity environment captures the full range of organisms.

Applying the technology to coral conservation

"Corals are sensitive and easily damaged, meaning observation can affect results and intended outcomes" says Sebastian.

Using human divers is difficult to scale and can disturb habitats. eDNA is much less invasive as samplers tied to buoys are dropped in place from boats. Current flows around coral reefs are dynamic, which Applied Genomics' account for by sampling over multiple tidal cycles to retrieve time series datasets.

Challenges, solutions and lessons learned

The biggest marine environment challenge concerns fluctuating tides. Sample collection that doesn't account for this generates lots of noisy data. By positioning its inDEPTH samplers for extended time periods, Applied Genomics obtains consistent reporting and data on significantly more species.

Opportunities for partnership

"Mostly, conservation organisations are poorly funded", says Sebastian. "eDNA's Achilles heel is that while you see high returns on investment represented by the resulting amount of data, the process of acquiring that data comes at a cost too". Typically it's only larger companies and industries like offshore oil and gas justifying that investment.

The business case

For Applied Genomics, coral has always been an important application. The motivation behind the company is to provide better data that can lead to better decision making and outcomes. "With marine conservation, not everybody thinks of eDNA first and as we do not advertise, we lack the outreach of large companies with marketing budgets. But they haven't invested in developing the technology to do large volume sampling like we have", says Mynott.

IP considerations

Applied Genomics provides its systems to anyone that wants to use them, and is open to sharing all of the data as part of the service.

«When you take an eDNA sample, you've got the full mixture of DNA from all the organisms. With reefs, you can see the fish, the invertebrates, even the corals themselves, giving the different dimensions of biodiversity»

Sebastian Mynott
General Manager & Founder,
Applied Genomics

What's next

Applied Genomics is currently working on a project with NEOM and will have all the data by the end of summer 2024. Looking ahead, there's an aim to implement AI to draw inferences across the data spectrum of all of our projects, and eventually work towards real time data production.

Credit: GRoW Oyster Reefs LLC

GRoW Oyster Reefs

Grow Oyster Reefs (GRoW) designs and fabricates biomimetic concrete reef substrates from calcium carbonate to protect shorelines, jumpstart reefs, and restore aquatic ecosystems. Primarily aimed at oyster recruitment, the company began with a provisional patent in 2015, approved in 2022, covering the concrete formula specifically for its 'Reef Tiles' and 'Reef Disks'.

Technology Overview

GRoW Oyster Reefs' patented concrete mix is formulated to match mature oyster shells. It results in a porous structure to support oysters' reef building capacities, simultaneously providing a safe habitat for larvae. These artificial reef tiles can be integrated into seawalls, are modular, and mimic the natural shell, including interstitial spaces and surface indentations to protect oysters from waves.

The structures made by Grow Oyster Reefs attenuate wave energy, protect shorelines, restore the seabed, balance pH, all while sequestering carbon through increased organism growth.

Concrete mix and substrate prototypes have been validated in coastal and estuarine waters from Maine to the Gulf of Mexico. Its 'Reef Tangle' has survived multiple extreme weather events. Modifications to the calcium carbonate content, surface topography, and predator proofing measures are being tested.

Cross-over potential to corals

Although designed for oyster habitats, similar biomimetic reef tiles could be developed to support coral growth following translocation. GRoW has already developed coral settlement plates that are in the lab-testing stage. Both types of reefs share similar carbonate compositions and are closely related in both structure and function.

Scalability

With National Science Foundation funding, GRoW is currently scaling production capabilities. This will allow the change of production modalities from wet cast to dry cast concrete. Today, the process for creating the tiles is handmade, creating around 250 per week. Looking towards 2025, the aim is to scale the process using machines, producing upwards of 2,000 tile units per day.

Location	US
Employees	8-10
Maturity	Startup
Founded	2015
Funding	RISE Resilience Innovations, Schmidt Marine Technology Partners, Matheson Oyster Company

Target Markets
Offshore wind, cable protection, aquaculture

Partnerships & Customers
Matheson Oyster Company, The Nature Conservancy, Massachusetts Institute of Technology

Taxonomy Tags

#environmental engineering #building underwater habitats

Evelyn Tickle
CEO & Founder,
GRoW Oyster Reefs

Evelyn has over 20 years of experience in concrete fabrication and invented GRoW's biophilic mix. She was an Architecture Fellow of the American Academy in Rome and a finalist in the 2021 Biomimicry Institute's Ray of Hope Prize.

All of GRoW Oyster Reef's work is reportedly collaborative, science-based, biomimetic and are developed in the lab for underwater deployment.

Applying the technology to coral conservation

In collaboration with scientists at Florida's SeaWorld, GRoW is testing coral recruitment to its substrates. This forms part of SeaWorld's Coral Rescue, which aims to preserve the currently declining local coral populations.[1]

The modular tiles, traditionally designed for oyster recruitment, can be integrated into seawalls or revetments, or arranged as inter-tidal archipelagos.

The porous tiles have interstitial spaces at many scales, facilitating the long-term recruitment and survival of corals and other reef-building organisms, and the rapid recruitment of other organisms, increasing biodiversity and overall reef health.

Challenges, solutions and lessons learned

A challenge when dealing with fragile ecosystems is ensuring no harm comes to them in the conservation process. Measures to define 'best practices' in coral restoration are crucial for GRoW Oyster Reefs, owing to the high risk of aquatic ecosystem damage.

"There are too many conservation projects and practices that have been and continue to be harmful, exacerbating the global decline in ocean health and biodiversity loss", says Tickle.

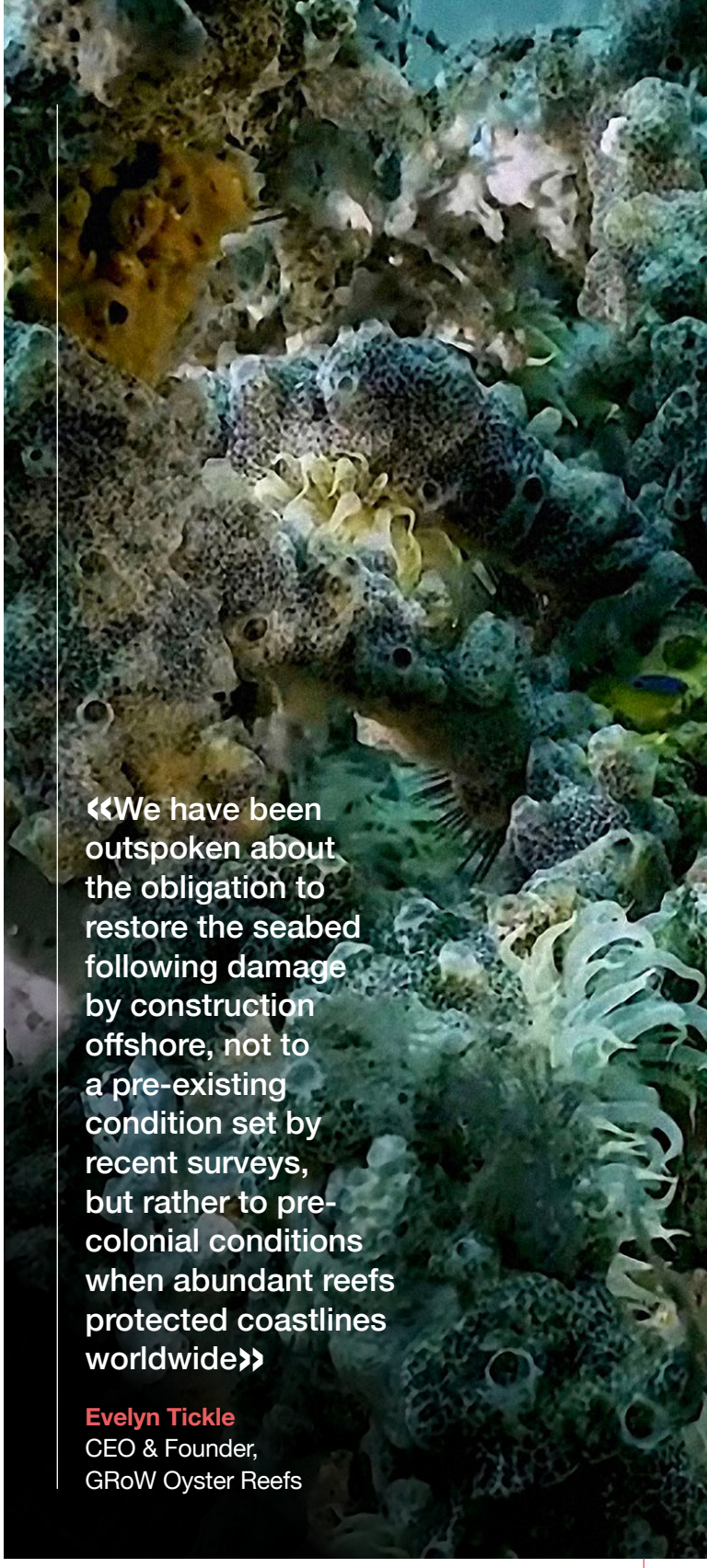
Other concerns centre on how substrate configuration can protect against predators and aid the recruitment survival of embryonic organisms that are able to recruit to the tiles.

Opportunities for partnership

Akin to reef restoration and species regeneration, conservation efforts rely on cooperation across groups. "We recognise the discomfort that organisations experience when confronted by obligations to share knowledge between sectors – but we see this is an educational opportunity, and CORDAP holds an important position, bringing specialists together with a common purpose", says Evelyn.

The business case

GRoW's engagement with corals is motivated by raising awareness of GRoW's capabilities, and social responsibility.



> «We have been outspoken about the obligation to restore the seabed following damage by construction offshore, not to a pre-existing condition set by recent surveys, but rather to pre-colonial conditions when abundant reefs protected coastlines worldwide»

Evelyn Tickle
CEO & Founder,
GRoW Oyster Reefs

Credit: GRoW Oyster Reefs LLC

IP considerations

While its products are patented, and future developments funded by grants would be subject to IP protection, the development of specific CORDAP funded products could be offered using an alternative open licensing model or as a modifiable low-cost product, dissociated from existing IP.

What's next

GRoW Oyster Reefs is prioritising reducing the cement content in its products. Ongoing funded work addresses the transition from oysters to corals specifically.

Credit: Australian Seaweed Institute

Australian Seaweed Institute

The Australian Seaweed Institute develops seaweed biofilters to offset ocean pollution. Founded in 2020, these filters remove nitrogen, reducing ocean acidification, and utilise harvested seaweed that can subsequently be used in livestock feed and bio-fertiliser. The company aims to create a network of filters across the Great Barrier Reef.

Technology Overview

The company's technology comprises seaweed-based filters that naturally soak up carbon, nitrogen, and phosphorus as they grow, simultaneously filtering carbon dioxide that is leached into the water through industry and farming. Seaweed biofilters in coastal waters can be used as a remediation tool in areas of excess runoff, creating a healthier environment for nearby coral reefs.

The seaweed is then harvested regularly from nets and removed from the marine environment – taking the excess nitrogen and carbon along with it. The harvested seaweed is then turned into useful agricultural products including a methane reducing livestock feed supplement and bio-fertilisers for crops, thus reducing further potentially damaging chemical run-off.

Following proof-of-concept validation, the first module is scheduled for installation in late 2024 to 2025, accompanied by environmental modelling to demonstrate its efficacy.

Cross-over potential to corals

Excess nutrient pollution in the form of nitrogen and carbon reduces the resilience of coral to stress events such as rising sea temperatures, ocean acidification, and invasive species. Using seaweed filters to capture pollutants has potential to result in cleaner, better quality water circulating the reef, improving its overall health.

Scalability

Trials are currently underway, with plans to deploy dozens of modules to significantly remove excess nitrogen damaging the reef within the decade. According to the Australian Seaweed Institute, modelling has shown that only a tiny fraction – less than 0.1% – of the Great Barrier Reef marine park area is needed to grow sufficient seaweed to meaningfully enhance water quality.

Location	Australia
Employees	5-10
Maturity	Startup
Founded	2020
Funding	Federal Australian Government Great Barrier Reef Foundation, Reef Trust

Target Markets
Agriculture, governments, local authorities, nitrogen credit issuers

Partnerships & Customers
Australian and Queensland governments

Taxonomy Tags

#environmental mitigation #marine interventions (biological)

Jo Kelly
CEO, Australian
Seaweed Institute

Jo's career spans sectors including aquaculture, financial services, insurance, defence and health. She is also the Chair of the Board of Australian Sustainable Seaweed Alliance.

Water quality problems and pollutants will also compromise reef dependent industries such as tourism, research, and education.

Applying the technology to coral conservation

Sedimentation and nutrient excess gives rise to algal growth as well as a build-up of pollutants. Combined, these reduce the amount of light reaching depths, and in some cases can smother corals. Nutrient run-off also shows links to a crown-of-thorns starfish, a substantial predator responsible for coral loss in the Great Barrier Reef.

Challenges, solutions and lessons learned

The Australian Seaweed Institute has a ten year plan to achieve impact at scale. There are other companies looking to cultivate seaweed for combined environmental and commercial purposes around the world. However, none are focussed on reef protection benefits. For the Australian Institute of Seaweed, the company recognises it can be difficult to raise funding for non-coral related research in coral conservation. Jo Kelly says, "seed funding and scale up of the first commercial biofilter will be important as a demonstration project and help to attract more industry and interest".

Opportunities for partnership

The company is primarily aimed at the Great Barrier Reef so far, but this solution could be locally adapted and applied to other reef locations around the world.

Australian Seaweed Institute is catalysing a new, nature positive seaweed sector in partnership with Indigenous groups, local communities, and the existing wild catch fishing sector, including the oyster industry. Together, it aspires to deliver the large-scale seaweed biofilters network needed to improve reef water quality.

The business case

The company aims to build collaboration with farming and local communities, establishing a whole new industry for regenerative seaweed aquaculture. According to Kelly, Australia has no commercial-scale seaweed farms and no industry development plan. She has worked on a seaweed industry blueprint, outlining the $1.5 billion blue economy opportunity that could employ 9,000 people.

IP considerations

When asked about IP considerations, Australian Seaweed Institute's perspective is that the more people with knowledge and greater investment into solutions the better. As such, it indicates that IP could be made available for conservation purposes.

What's next

Australian Seaweed Institute is currently at the second stage of its five-step, ten-year plan. Once field trials are complete it will deploy environmental monitoring and reporting tools to be followed by a processing facility.

Credit: Blue Carbon Pty. Ltd

Blue Carbon

Blue Carbon designs 'aquabots' for remote ocean water pumping. Target use cases include cooling marine heatwaves, reviving marine ecosystems, and supporting sustainable aquaculture. Currently, its focus is providing oxygenated water for fish farms, replacing conventional diesel-powered systems. This application is at commercial trial stage, beginning in-situ tests in July 2024.

Technology Overview

Floating, renewable-powered (wave, solar and wind) 'pods' pump cooler water from deep in the ocean up to the surface, replicating the natural vertical circulation patterns. 'Sprinklers' near the surface then disperse a protective cushion of cool water, for example over shallow-water heat-stressed reefs. A single large pod will recirculate 17 Olympic swimming pools (43,624 m^3) in an hour, although a range of sizes are available. Designed for an ocean life of over 25 years, the autonomous pods are equipped with sensors to measure and record ocean-health metrics.

Furthermore, redistributed phytoplankton are eaten by marine life, transferring carbon in the food chain. Organisms then die and fall as 'marine snow', sequestering carbon on the ocean floor with it. One pod removes approximately 1,360 tonnes of carbon per year.

Cross-over potential to corals

Reef restoration is specifically targeted, with the pods delivering cooler water from the deep ocean directly to the shallow warmer waters around coral reefs. This could provide a countermeasure against temperature spikes and protect corals from bleaching. Recirculation additionally brings nutrient-rich currents containing microscopic algae and seaweeds to shallower water.

Scalability

Blue Carbon estimates that four of its units can cover roughly 97 hectares of reef. Production would require a considerable investment in manufacturing capacity. The company's strategy includes using revenue from aquaculture applications to help fund reef conservation efforts, with the goal of achieving economies of scale that will lower costs over time and make the technology more accessible.

Location	Australia
Employees	2-10
Maturity	Startup
Founded	2021
Funding	Revenue funded growth

Target Markets
Aquaculture, fisheries

Partnerships & Customers
Australian Institute of Marine Science

Taxonomy Tags

#aquaculture #marine interventions (physical)

Ana Novak, Eva Chiu
Co-founders, Blue Carbon

Ana is CEO of Blue Carbon, with previous director experience in communication platforms and software. Eva is serving as CFO, and is also the managing director of a company manufacturing high volume consumer goods.

Blue Carbon is focussing on aquaculture endeavours to provide revenue. Its goal is to subsequently make the technology more affordable to governments and conservation organisations worldwide.

Applying the technology to coral conservation

Blue Carbon believes its technology can tackle coral reef destruction caused by extreme heat stress. Cool water is pumped up from depth, oxygenated, and scattered over shallow-water reefs.

Other studies have shown that injecting deep water has the potential to cool shallow reefs by >0.15°C, with Blue Carbon's renewable-energy approach reportedly offering cost reductions relative to diesel pumps.[2]

Potential barriers

A significant challenge is that, despite recreational diving and associated tourism being substantial industries, they are highly fragmented with many small players that individually are unable to fund large conservation projects. As such, Blue Carbon is targeting governments as potential clients.

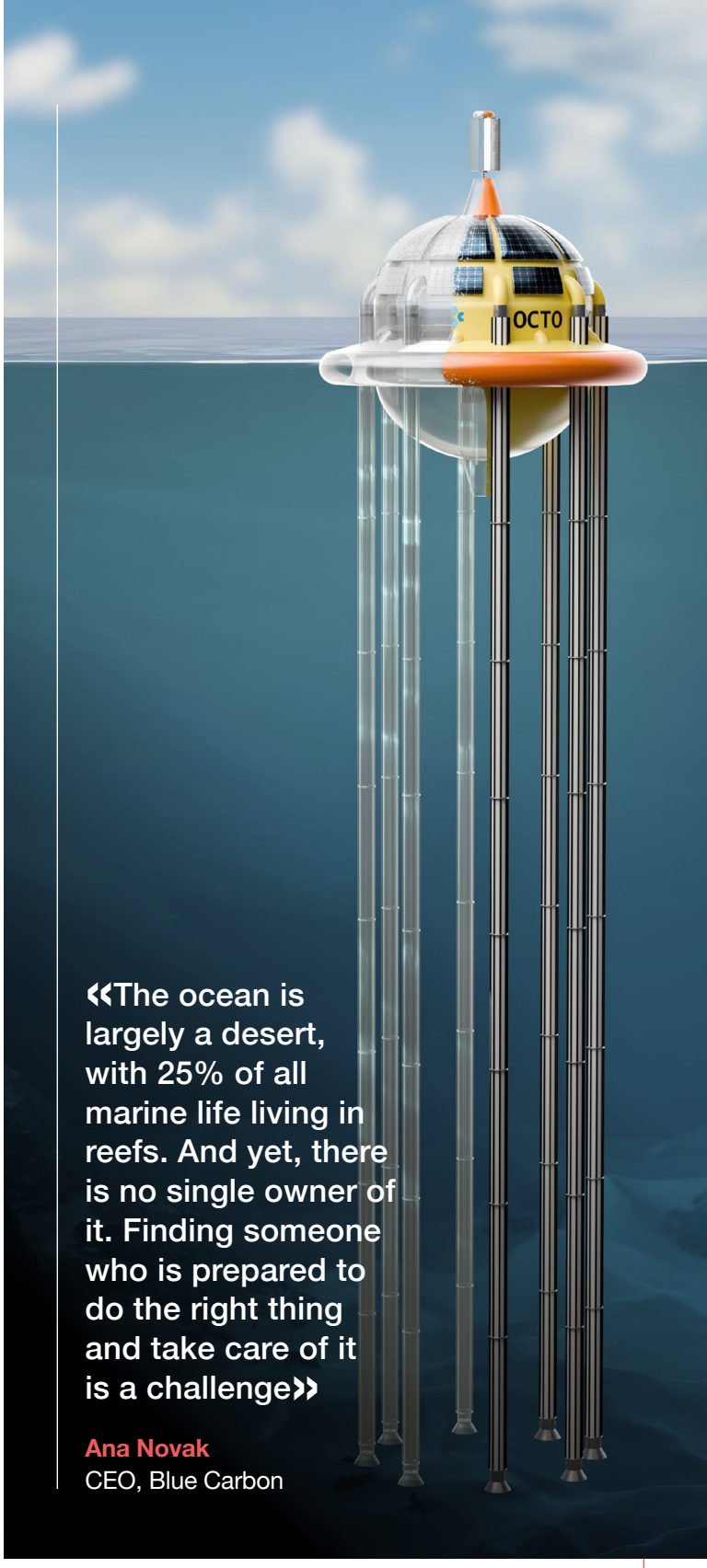
In the case of large shallow-water shelves, deploying Blue Carbon's technology may require trenches through the existing ecosystem to lay the piping. This would require cost/benefit analysis on a reef-by-reef basis.

Opportunities for partnership

While not yet deployed at scale, partnering with Blue Carbon's would offer access to a technology developed primarily for commercial aquaculture. Deploying it for coral conservation would thus have reduced R&D costs, along with economies of scale in manufacturing.

The business case

Blue Carbon's core business is supporting aquaculture, which it envisages will be sufficiently profitable to fund product development. However, the founders are highly motivated to utilise its technology for coral conservation: "We are focused on aquaculture for revenue. When it comes to the reefs, we're willing to do it anywhere at cost".



«The ocean is largely a desert, with 25% of all marine life living in reefs. And yet, there is no single owner of it. Finding someone who is prepared to do the right thing and take care of it is a challenge»

Ana Novak
CEO, Blue Carbon

Credit: Blue Carbon Ply. Ltd

IP considerations

Blue Carbon reports that it is important to retain the background IP which is tied to other commercial activities. However, it is passionate about protecting reefs. In principle, IP developed from potential collaborations with CORDAP would be made affordable to interested conservation-focus parties.

What's next

Blue Carbon is putting greater emphasis on the aquaculture industry as it provides significant revenue that could build the business. Soon, the company will begin trials in Tasmania.

Align Technology

Align Technology is a global medical device company that develops intra-oral scanners (iTero™) and clear aligners (Invisalign®). These scanners have reportedly been used in over 14 million teeth restorations and orthodontic treatments. Currently, the company is targeted solely at the medical sector, and has no prior experience with coral conservation.

Technology Overview

The iTero scanner is a small handheld device that uses parallel confocal microscopy imaging in the visible spectrum. Designed to go inside patient mouths, it can be manoeuvred to image corners and sides of teeth, and displays a digital 3D representation.

Furthermore, iTero's near-infrared imaging (NIRI) capability uses light with a wavelength of 0.85µm to scan internal teeth structure, mapping shade and shape. The system digitally captures the 3D geometry and colour of dental structures using a proprietary optical, non-contact, focus detection technique. Notably, NIRI technology aids in detection and monitoring of interproximal caries, reducing the health risks and complexity associated with X-ray ionising radiation.

Combined with iTero's TimeLapse feature, evolution in dental structure between scans can be monitored in the 20µm scale, creating a time-dependent picture of oral health.

Cross-over potential to corals

Coral skeletons are made up of calcium carbonate, which is similar to the calcium phosphate mineral that constitutes tooth enamel, thereby suggesting similar scanning performance and a non-invasive imaging approach. Marine biologists have used an iTero scanner to measure juvenile corals non-invasively on land and in under 3 minutes – a process which typically takes 4+ hours.[3]

Scalability

As a global manufacturing and technology company with a 2023 revenue over £3 billion, Align Technology and its iTero division are poised to scale up capabilities. Today, doctors in upwards of 100 markets use its orthodontic solutions. The company manufactures the aligners in Juarez (Mexico), Wroclaw (Poland), and China, and its scanners in Israel and China, demonstrating its extensive capabilities.

Locations	US, Mexico, Israel, China, Poland
Employees	10,000+
Maturity	Corporate R&D
Founded	1997
Funding	Revenue funded growth, publicly traded company

Target Markets
Dentistry, orthodontics

Partnerships & Customers
Asia Pacific, University of Washington

Taxonomy Tags

#monitoring sensors #coral imaging

Align Technology's iTero scanners, widely deployed for dental imaging, have already been trialled by marine biologists to rapidly acquire 3D coral images.

Applying the technology to coral conservation

Corals demonstrate a range of morphologies, presenting a challenge for classification. Furthermore, temporal morphological changes that may correlate with health make detection difficult.

iTero's NIRI capability could be used to detect important structures within coral tissues that correlate with health. Currently the scanning technology has been applied for scientific studies to larvae and juveniles in land-based nurseries, but if adapted for underwater deployment could map changes over time.

Potential barriers

Despite being designed to work in the relatively wet environment of the mouth, iTero scanners are not able to operate entirely underwater as rays would refract and special calibration would be needed. Conceivably the scanners could be placed within a protective case to prohibit water from entering while capturing data on a shallow dive, but this would have to preserve optical fidelity.

Furthermore, the scanner 'wands' currently require a power supply and a live data readout to computers – if deployed in the field or underwater these would have to be replaced with a battery and data storage capability.

Opportunities for partnership

Prior to this report, iTero was unaware that its technology had crossover potential to coral conservation. With a thriving business already up and running, its potential involvement in coral restoration would be to provide technical support, for example advising on adaptation for use underwater, and the equipment itself.

The business case

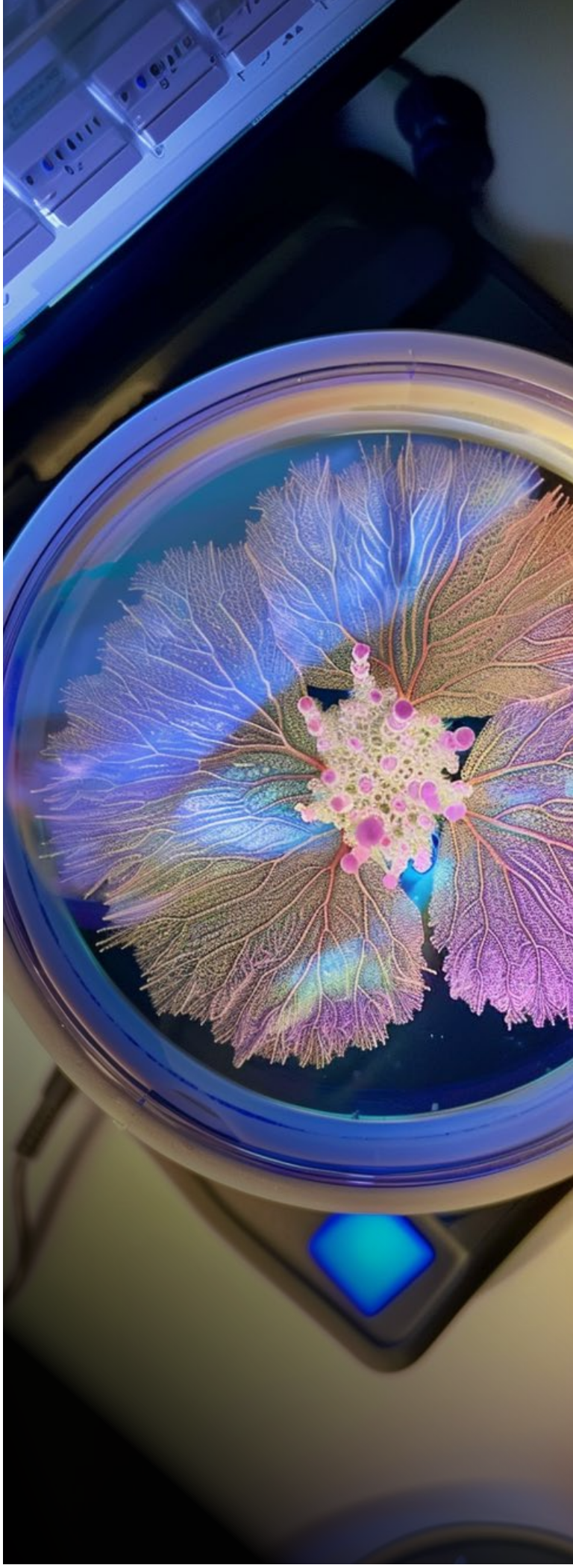
iTero is involved in other social responsibility initiatives, including supporting intraoral scanning for children with cleft lips and palates. Any engagement with marine conservation would not be driven by commercial gain, but could help meet broader sustainability objectives.

IP considerations

Typically, iTero projects retain IP in-house. However, with collaborations from industries outside its ordinary remit, for example potential underwater scanning, in principle the company would be open to providing technical support and sharing IP.

What's next

iTero is working on continuously improving its existing product offering, ensuring tools are faster, smaller, and more precise. Cost and size reductions could ultimately assist adaptation for underwater deployment for coral monitoring.



Appendix

A sample of over 200 private sector players were mapped across both coral-specific and adjacent industries, with an overview provided in the table. Companies are segmented across five distinct categories: marine informatics, environmental engineering, aquaculture, biotechnology, and environmental mitigation. Further information on these players, including maturity, company size, technological overview, specific case studies, and details of crossover potential for coral restoration, was also determined as part of this project. It is planned that this database will be added to, growing into a comprehensive global resource of coral relevant industries and technologies. To be added to this list, please contact CORDAP at the contact details provided at the end of this report.

Environmental engineering

ID	Organisation	Location	Company overview	Target markets	Ref
1	Archireef	Hong Kong	Archireef was founded in 2020 to restore degraded marine ecosystems, offering the first 3D-printed reef tile made from clay that promises a coral survivorship rate of 95%. Archireef primarily works with private sector businesses.	- Governments - Universities - Private sector	Ref
2	Blue Regeneration	Spain	Blue Regeneration is a Spanish company, producing BioRock, a building material designed for seawater applications. The material was invented in 1976 specifically for coral reef restoration in the Caribbean, Indian Ocean, and Pacific.	- Reef restoration	Ref
3	Coastruction	Netherlands	Coastruction produces and installs 3D-printed coral reefs using local and natural materials. Established in 2021, it uses natural, local, and recycled materials. Designed to be deployed in remote locations, the printed structures are site-specific.	- Coral reef restoration - Habitat restoration	Ref
4	CyBe Construction	Netherlands	CyBe Construction develops technology for 3D concrete printing. Established in 2013, it provides hardware, software, durable building materials, and a digital learning platform for construction. The technology is modular and mobile, and is designed to be faster and cheaper than conventional 3D printing.	- Construction	Ref
5	D-Shape	UK	D-Shape was founded in 2004 with the aim of scaling up 3D printing for architecture. As well as construction and urban design, D-Shape focuses on the printing of nature-inclusive marine structures such as coastal protection modules and artificial reefs.	- Coral reef restoration - Coastal defence - Manufacturing	Ref
6	ECOncrete	Israel	ECOncrete was founded in 2012 by marine biologists and ecological engineers with a mission to improve the biodiversity of coastlines increasingly dominated by concrete and develop structural solutions that work with nature. It has deployed 40 projects in 9 different seas.	- Coastal protection - Marine conservation - Coral reef restoration	Ref
7	Grow Oyster Reefs	US	Grow Oyster Reefs designs and fabricates biomimetic concrete reef substrates from calcium carbonate to protect shorelines, jumpstart reefs, and restore aquatic ecosystems. Primarily aimed at oyster recruitment, the company patented the concrete formula for its 'Reef Tiles' and 'Reef Disks' in 2015.	- Offshore wind - Cable protection - Aquaculture	Ref
8	Holcim	Switzerland	Holcim is primarily a construction company, producing cement, aggregates, ready-mix concrete, and other building materials including concrete, asphalt, and mortar. In 2020 the Forbes Global 2000 ranked it as the 280th largest public company in the world.	- Habitat restoration - Coral restoration	Ref
9	Innoqua	Japan	Innoqua was founded in 2019 in Tokyo (Japan) to enable the replication of marine environments in a range of anthropogenic settings through the use of remote sensing and artificial intelligence. It is applying this technology to marine research laboratories, coral reef regeneration, and aquaculture.	- Aquaculture - Marine research - Coral reef restoration	Ref
10	IntelliReefs	US	IntelliReefs began in 1998 as a stone casting company that focused on developing nanomaterials and improving the quality of cement. Since rebranding and focusing on coral reefs, IntelliReefs has deployed three artificial reefs globally.	- Coral reef restoration - Habitat restoration	Ref
11	Kind Designs	US	Kind Designs is a Miami-based startup, founded in 2022, that 3D prints reefs as a replacement for traditional seawalls. The business is aimed at the marine construction industry and has in-house printers. The seawall structures are Environmental Product Declaration (EPD) certified, meaning they have low environmental impact.	- Coastal protection - Marine conservation - Coral reef restoration	Ref
12	Mars	US	The Mars Coral Reef Restoration programme is operated by Mars, the large multinational corporation behind confectionary products like the Mars bar. Coral reef restoration is part of its Mars Sustainable Solutions division, which also works to reduce deforestation.	- Confectionary - Food - Pet food - Coral reef restoration	Ref
13	Mussel Polymers	US	Mussel Polymers was launched in 2019 and develops underwater bonding technology for adhesives, coatings, and wet adhesion applications. It has worked on projects from coral restoration to ship repair, from medical to military applications.	- Oil and gas - Military - Marine aquascaping - Cosmetics	Ref
14	Objects and Ideograms	US	Objects and Ideograms is a design workshop based in Oakland, California, US. It carries out research projects for clients, using design technology and fabrication processes to create custom or standard structures.	- Artisan industry	Ref
15	Ocean Ecostructures	Spain	Open Ecostructures creates biomimetic micro-reefs in combination with monitoring and analysis systems. Founded in 2018, it uses regeneration technology, robotics for result monitoring, and AI for data processing.	- Marine conservation - Habitat restoration	Ref
16	Partanna	Bahamas	Partanna was founded in 2021, targeted towards commercial scalable construction and advanced materials. Its team comprises architects, material scientists, and entrepreneurs. It produces carbon-negative, seawater-resistant concrete to act as foundations for marine life.	- Construction - Desalination	Ref
17	Reef Design Lab	Australia	Reef Design Lab is a multidisciplinary design company founded in 2015, focused on designing coastal structures which conserve marine life. It offers a number of services, from artificial reef construction to designing environmentally benign sea walls.	- Habitat restoration - Coral transplantation	Ref
18	Reef Innovations	US	Reef Innovations is a US company that has been operating for over 30 years, deploying its structures at sites around the world in coastal protection and reef regeneration projects. It supplies 'Reef Ball' molds and materials worldwide, offering custom-built solutions.	- Coastal protection - Marine conservation - Coral reef restoration	Ref
19	ReefSystems	Netherlands	ReefSystems was founded in 2017 and provides solutions to clients wanting to stimulate biodiversity. It provides three main products: MOSES, designed for coral reef restoration, SPECTER, for swampland restoration, and REFPOOL, which mimics natural rock pools.	- Habitat restoration - Coastal protection - Biodiversity monitoring	Ref

Environmental engineering

ID	Organisation	Location	Company overview	Target markets	Ref
20	Reefy	Netherlands	Reefy is a Dutch startup, founded in 2019, that develops modular artificial reef systems. The co-founders come from hydraulic engineering and marine biology backgrounds respectively. It helps coastal and marine developers to achieve environmental requirements.	- Coastal engineering - Marine monitoring - Tourism - Coral reef restoration	Ref
21	Resting Reef	UK	Resting Reef transforms the ashes of those who have died into oyster reef memorial structures that regenerate marine biodiversity, capture carbon, filter water, and prevent coastal erosion. Its formula has been tested at the London Aquarium and deployed throughout UK waters.	- Coral reef restoration - Habitat restoration - Death care	Ref
22	rrreefs	Switzerland	Rrreeefs builds modular, artificial reef structures, using 3D printed bricks made of clay. Founded in 2020 as a spin-off from ETH Zurich, a public research university in Switzerland, the company produces shape-customised hollow bricks in a Lego-like architecture.	- Tourism - Coral reef restoration - Marine conservation	Ref
23	The Reef Company	Portugal	The Reef Company is a small startup founded in 2021, which develops technologies for constructing and monitoring artificial reefs. It plans on building 3,000 new artificial reefs, covering 250,000 square kilometres, in the next 30 years.	- Marine monitoring - Reef restoration	Ref
24	Van Oord	Netherlands	Van Oord is a Dutch, family-owned company that was founded over 150 years ago. It provides services in dredging, marine construction, offshore wind, and offshore infrastructure. Notably, it has developed a mobile aquaculture laboratory termed ReefGuard for producing genetically-diverse coral.	- Coral reef restoration - Habitat restoration	Ref
25	Andromède Océanologie	France	Andromède Océanologie, founded in 2,000, focuses on the study and restoration of marine ecosystems, with two specialities: posidonia meadows and bio-constructed reefs. It aims to integrate each coastal or offshore project into its natural environment.	- Marine conservation - Habitat restoration	Ref
26	Biota Group	US	Biota Group is a marine company based in Palau and Florida. It specialises in land-based nurseries, sustainable aquaculture, captive breeding, and translocation of marine species. Although primarily working with the aquarium industry, it is moving into reef restoration.	- Aquarium industry - Aquaculture	Ref
27	Blue Planet Ecosystems	Austria	Blue Planet Ecosystems builds, develops and operates modular LARA (Land-based Automated Recirculating Aquaculture) systems for sustainable seafood production. It converts CO_2 and sunlight into sugars, amino and fatty acids.	- Aquaculture	Ref
28	Coral Vita	The Bahamas	Coral Vita was founded by two Environmental Management graduates. The company farms resilient corals that have withstood typically hazardous events on land. Its locations serve as education centres for local communities as well as ecotourism attractions.	- Coastal restoration - Coral reef restoration	Ref
29	Egis	France	Egis is an international firm active in consulting, construction engineering and mobility service sectors. It has been involved in designing restoration efforts for marine environments and ranks 9th in the world for transportation engineering.	- Construction - Rail - Maritime transport - Geotechnical engineering	Ref
30	Iberostar Group	Spain	Iberostar is a global tourism and resort company. It has made saving coral reefs a pillar of its Wave of Change programme through establishing nurseries and research labs near its resorts. Part of its mission is to create a responsible tourism model.	- Tourism - Coral reef restoration - Marine conservation	Ref
31	SciReef	Germany	SciReef is a spin-out from the University of Oldenburg's Institute for Chemistry and Biology of the Marine Environment. It collaborates with Tropic Marin, a seawater aquarium supplies company based in Switzerland.	- Aquaculture - Marine research - Coral reef restoration	Ref
32	Sea Boost	France	Sea Boost, founded in 2013, specialises in the design of solutions for marine restoration. Its main range of products comprises artificial habitats, either self-standing or as modules to be fixed on different maritime infrastructures to increase their colonisation by marine fauna and flora.	- Habitat restoration	Ref
33	ARC Marine	UK	ARC Marine was founded by a group of divers in 2015 with a mission to restore biodiversity and reefs. It installs artificial reefs across the globe to both enhance biodiversity and serve as subsea protection, coastal defences, moorings, and marine foundations.	- Aquaculture - Coral reef restoration	Ref
34	Deborah Brosnan & Associates	US	Deborah Brosnan & Associates is an international scientific consulting company that provides strategic advising helping businesses develop climate-resilient strategies. The company was founded by a marine scientist and climate risk expert.	- Environmental consulting - Reef restoration - Coastal protection	Ref
35	Ecocean	France	Founded in 2013, Ecocean is a French startup that specialises in post-larval capture and culture of fish to improve the sustainability of the marine environment. Its activities focus on four complementary fields: sustainable fish rearing, ecological restoration, fishing & rearing devices, and diagnosis.	- Fishing - Aquaculture - Ecological restoration	Ref
36	Kajima Corporation	Japan	Kajima Corporation is one of the oldest and largest construction corporations in Japan. Founded in 1840, it builds commercial, residential, and institutional buildings that are earthquake-resistant. Its research facility, Hayama Marine Science Laboratory, was established in 1984 to investigate aquatic environments, specifically how to preserve or restore them.	- Construction	Ref
37	Natrx	US	Natrx was founded in 2018 and has deployed over 50,000 tonnes of biogenic living shoreline. Its software produces site and habitat specific infrastructure designs, which the company can then manufacture from sand and concrete prior to deployment.	- Architecture - Engineering - Manufacturing	Ref
38	Nurtured.Co	Australia	Nurtured.Co is an Australian startup, founded in 2020, that creates naturalistic but artificial coral reef structures of any scale. It currently designs reefs for Moreton Bay (Australia) and is looking to expand into seaside residences and hotels.	- Coral reef restoration - Habitat restoration	Ref
39	Pentair Aquatic Eco-Systems	US	Pentair Aquatic Eco-Systems was established in 1978 and provides services and equipment for commercial aquaculture. Its systems, including for recirculation and filtration, are used to improve water conditions and would thus be suited to coral nurseries.	- Aquaculture	Ref
40	RoffaReefs	Netherlands	RoffaReefs is aiming to develop effective breeding systems for reef critters and minimise pressure on reefs from the aquarium sector. RoffaReefs was founded by an aquarist working at Rotterdam Zoo who had previously worked on development of the vegan fish feed and complementary 3D feeding racks.	- Aquaculture - Coral reef restoration	Ref
41	Seascape Caribbean	Jamaica	Seascape Caribbean is a consultant contractor, founded in 2008, that specialises in nearshore marine coral and reef ecosystem services. It carries out coral culture, reef restoration, replanting, and 'reef-gardening', along with developing artificial reefs for wave attenuation.	- Coral reef restoration - Environmental consulting	Ref
42	Tenaka	France	Tenaka is a startup founded in 2018 which helps companies collaborate with local communities and design programmes for the restoration of coral reefs and mangrove forests. It develops tailor-made programmes designed to engage business staff, customers and stakeholders.	- Land and oceanic conservation	Ref

Marine informatics

ID	Organisation	Location	Company overview	Target markets	Ref
43	Anemo Robotics	Denmark	Anemo Robotics is a startup based in Copenhagen that develops hardware and software for biodiversity monitoring, primarily to measure the impacts and effects of wind farms. It builds underwater cameras and uses AI to enumerate fish.	- Offshore wind - Marine ecosystem monitoring	Ref
44	Aqoustics	UK	Aqoustics, founded in 2023, is using AI to process underwater sound data and monitor ocean biodiversity. Utilising low-cost recording equipment and AI-driven visualisations to create 'soundscapes'.	- Aquaculture - Acoustic ecological monitoring - Marine research	Ref
45	blueOASIS	Portugal	blueOASIS is a research services company providing Industry 4.0 tooling for ocean care. Founded in 2021, it aims to optimise renewable platforms, carry out hydrodynamic analysis, develop code, and detect pollution.	- Renewable energy - Maritime - Offshore engineering - Marine research	Ref
46	Ellipsis Earth	UK	Ellipsis Earth remotely identifies, maps and tracks plastic waste using machine learning and imagery. Founded in 2019, its technology has been used on National Geographic Expeditions and is designed for road traffic, beaches and coastal areas, urban spaces, waterways and rural spaces.	- Pollution remediation - Food and drink - Government	Ref
47	Marmoris	Netherlands	Marmoris is an early-stage startup based in the Netherlands. It uses geographic information systems, remote sensing, and AI to help stakeholders involved in coastal ecosystem conservation make data-driven decisions to increase the effectiveness of their work and lower costs.	- Marine conservation - Coastal restoration	Ref
48	Reef Support	Netherlands	Reef Support develops and maintains open-source marine research software as well as 3D photogrammetry toolkits which can be available on a pay-per-model basis. It works with over 30 organisations worldwide, specialising in reef, cetacean, and shark protection.	- Marine ecosystem monitoring	Ref
49	SeaDeep 2.0	US	SeaDeep was founded in 2020 after being spun out from Tufts University. It combines computer vision, machine learning, and data analytics to map and monitor underwater assets. It has a record of publications, patents, and global public engagements, such as the G20.	- Monitoring of offshore infrastructure	Ref
50	SINAY	France	SINAY is an environmental consultancy and IT services provider. It offers metocean software, container training, and other tools to monitor weather and ocean freight activity. Its expertise lies in weather, ocean health, ocean fauna, and freight logistics.	- Marine research - Maritime - Ocean shipping	Ref
51	Stream Ocean	Switzerland	Stream Ocean is a startup founded in 2022, which provides AI-powered solutions to marine monitoring and data collection. Key products include an autonomous monitoring camera, cloud-based analytics and visualisations, as well as marine conservation consulting services.	- Marine monitoring - Aquaculture - Offshore wind	Ref
52	Wildflow	UK	UK-based Wildflow is an open-source AI-driven platform that specialises in multimodal marine biodiversity data. The aim is to foster in-depth study of ocean ecosystem dynamics by democratising access to specific tools.	- Marine research - Environmental monitoring - Government	Ref
53	Aquaai	US	Aquaai is an early stage Californian company, founded in 2014, that develops AUVs to enable 'easy & affordable access to reliable visual & environmental data from waterways'. Its bio-inspired AUVs are available via an 'as a service' subscription model, rather than being available for sale.	- Marine biology research - Ecological restoration - Environmental monitoring	Ref
54	EOMAP	Germany	EOMAP is a research and consultancy company, carrying out optical remote sensing of marine environments. It supports both industry and government clients in satellite-derived bathymetry, seafloor classification, and water quality monitoring.	- Mapping and monitoring aquatic environments	Ref
55	Frontier Robotics	UK	Frontier Robotics provides software for maritime robotics, specialising in visual perception, SLAM, and autonomy for maritime inspection. The system is platform agnostic and based out of The National Robotarium in Edinburgh.	- Underwater exploration - Maritime industry	Ref
56	Kraken Robotics	Canada	Kraken Robotics is a marine technology company formed in 2012 which develops sensors and underwater robotic systems. Its main products are synthetic aperture sonar systems, which it produces for multiple operational depths.	- Ocean exploration - Deep sea mapping - Marine monitoring	Ref
57	PlanBlue	Germany	PlanBlue is a German startup, founded in 2017, developing both hardware and software solutions for mapping and monitoring seabeds. Products include seafloor mapping hardware, and software for AI-based automation, and planning underwater missions.	- Seafloor mapping	Ref
58	Planet	US	Planet provides global, daily satellite imagery and insights. Founded in 2010 by three NASA scientists, Planet designs, builds, and operates a large fleet of imaging satellites, as well as online software, tools and analytics. Target markets include the maritime industry.	- Agriculture - Government - Maritime - Forestry - Mapping	Ref
59	Vaarst	UK	Vaarst is a UK-based company founded around 2021, which develops stereo 3D mapping cameras along with a data and machine learning platform. It offers solutions for seabed surveys, underwater inspections, and marine biology research.	- Marine imaging - Data analytics - Robotics	Ref
60	Voyis	Canada	Founded in 2007, Voyis provides optical solutions such as underwater laser scanners and imaging payloads, designed to enable advanced subsea surveys for organisations. Its primary target is the maritime transportation industry.	- Defence - Fisheries - Offshore energy	Ref
61	Whitecap Scientific Corporation	Canada	Whitecap Scientific Corporation is a small startup founded in 2011 that develops computer vision software. ROV3D is based on a research paper published in 2015. The company primarily focuses on monitoring underwater structures for oil and gas companies.	- Monitoring subsea assets - Oil and gas	Ref
62	Aanderaa	Norway	Aanderaa has more than 50 years of experience in environmental research, specifically instrument solutions for oceanographic measurements. It designs, manufactures, and sells sensors and the associated software systems for data readout and analysis.	- Environmental research - Oil and gas - Aquaculture	Ref
63	Accenture (teamed with Intel and Sulubaai Environmental Foundation)	US	Accenture is a leading global professional services company specialising in IT. It has over 9,000 clients served across more than 120 countries. Intel is a technology company specialising in hardware. In 2020, Intel was ranked 45 on the Fortune 500 list. In collaboration, they have worked on software for coral monitoring.	- Information technology services - Consulting	Ref
64	Advanced Navigation	Australia	Advanced Navigation is a large AI, robotics, and navigation company, headquartered in Australia. It provides solutions for air, sea, and land. It has a global presence, and both manufactures hardware and develops software in-house.	- Marine monitoring	Ref
65	Align Technology	US	Align Technology is a global medical device company that develops iTero scanners and Invisalign for the dental industry. It specialises in orthodontic and restorative treatments, with the iTero scanners being used in more than 10 million restorations. It is targeted solely at the medical sector, and has no prior experience with coral conservation.	- Dentistry - Medical	Ref
66	BioSonics	US	BioSonics was founded in 1978 and is a provider of acoustic monitoring systems for studying marine ecosystems. BioSonics' technology utilises advanced sonar systems to collect high-resolution data on marine life, including fish, zooplankton, and marine mammals.	- Marine monitoring - Underwater habitat assessments - Fish surveying	Ref
67	Blue Ocean Marine Tech Systems	Australia	Blue Ocean Marine Tech Systems and its parent company, Blue Ocean Monitoring, were founded in 2014 and based in Perth Australia. It focuses on marine data collection using autonomous underwater vehicles.	- Energy - Defence - Environmental monitoring	Ref

Marine informatics

ID	Organisation	Location	Company overview	Target markets	Ref
68	Blueye Robotics	Norway	Blueye Robotics specialises in underwater drones and was founded in 2015 by a team of marine engineers, software developers, industrial mechanics, and electronics designers. It has clients in more than 40 countries, providing technology for projects including dam inspections, aquaculture, ship inspections, waste and drinking water management, marine surveillance and tourism.	- Marine surveillance - Underwater inspections	Ref
69	Bosch Sensortec	Germany	Bosch Sensortec, a subsidiary of Bosch, develops and manufactures micro electromechanical systems (MEMS) sensors. Founded in 2005, the company focuses on providing advanced sensor solutions for a wide range of applications including consumer electronics, automotive, industrial, and IoT.	- Manufacturing - Consumer electronics - Automotive - Wearable technology	Ref
70	EIVA	Denmark	EIVA is a Danish engineering company with over 45 years of experience in oceanography and supporting offshore operations. It provides both hardware and software to a broad range of customers and claims to be able to support any subsea task.	- Civil infrastructure - Environmental monitoring - Marine research - Marine monitoring	Ref
71	Equinox Drones	India	Equinox Drones was founded in Bangalore, India, to develop high-quality geospatial solutions for both the private and public sectors. To date, it has completed 500+ projects resulting in surveys of 100,000+ acres of land.	- Aquaculture - Marine research - Marine monitoring	Ref
72	Exail	France	Robotics company Exail produces autonomous underwater drones traditionally used for underwater pipeline inspection and seabed mapping. It works across maritime, navigation, aerospace, and photonics technologies, with an annual turnover of €250 million.	- Maritime industries - Deep water surveying - Pipeline surveying - Navigation	Ref
73	Fathom Ocean	US	Fathom Ocean designs, builds and deploys long-term ocean monitoring solutions. The company utilises live-streamed video, audio, and integrated sensors to observe underwater environments. Founded in 2021, one of its core markets is conservation organisations.	- Marine monitoring - Marine research	Ref
74	Flying Fish Technologies	Australia	Flying Fish Technologies was founded in 2017 to monitor the Great Barrier Reef, and performs extensive surveys of coral reefs using a fleet of underwater 'gliders', and analysis tools to identify and catalogue biodiversity and create digital twins of a reef. It has been accepting contract work since 2022.	- Marine monitoring - Underwater vehicles	Ref
75	GPA Seabots	Spain	Established in May 2019, GPA Seabots specialises in the development of marine and naval robotics and unmanned surface vehicles. It is a spin-off of GPAINNOVA, which has more than 600 worldwide clients and had a turnover of €26 million in 2022.	- Marine monitoring - Defence - Marine research	Ref
76	Hydronalix	US	Founded in 2009, Hydronalix produces autonomous surface vehicles (ASVs) for oceanographic research and monitoring. It provides a full complement of capabilities including: R&D; design and prototyping; test and evaluation; production; and customer training. It has produced around 2,000 systems over its lifetime.	- Marine monitoring - Defence	Ref
77	Innovasea	US	Innovasea designs solutions for fish tracking and farming. Founded in 2015, it provides sensing equipment, acoustic telemetry tools, and consulting services. It offers services for land-based and open-ocean aquaculture.	- Aquaculture - Fisheries - Food industry	Ref
78	Liquid Robotics	US	Liquid Robotics was founded in 2007. Boeing bought Liquid Robotics in 2016, making Liquid Robotics a subsidiary of the Boeing Company. Liquid Robotics is based in Virginia and has an Engineering & Test Facility in Hawaii.	"- Defence - Fisheries - Offshore energy"	Ref
79	Open Acoustic Devices	UK	Open Acoustic Devices designs, supports, and deploys open-source acoustic hardware and software for environmental and wildlife monitoring. The company began as a research project at the University of Southampton recording acoustics in the forests of Belize.	- Acoustic ecological monitoring	Ref
80	Open Ocean Robotics	Canada	Open Ocean Robotics was founded in 2018 by two rowers to address the need for robots capable of enhanced data gathering in the oceans for long periods. The technology draws on their experience crossing the Atlantic in a solar-powered rowing boat.	- Ocean exploration - Marine monitoring - Marine research	Ref
81	Plastic-i	UK	Plastic-i is using satellite data and AI to map floating plastics in oceans, rivers, and lakes. It was the winner of the Innovate UK Smart Sustainable Plastic Packaging Challenge in 2023. The company works with governments, environmental agencies, NGOs, corporations, and financial institutions.	- Marine monitoring - Government	Ref
82	Reef Pulse	France	Reef Pulse, founded in 2021, specialises in sound recording and AI-based analysis for coral reef monitoring. Its type of technology is already being used by the oil and gas industry, so is proven to work at scale and is completely passive.	- Ecoacoustics - Marine monitoring - Oil and gas	Ref
83	ReefSense	Australia	ReefSense was established in 2006 to facilitate research with international and Australian collaborators. It has had continuous contracts with the NOAA Coral Reef Watch (CRW) programme for the past 18 years to support coral monitoring.	- Marine monitoring	Ref
84	Saab Seaeye	Sweden	A division of defence manufacturing parent company, Saab Seaeye specialises in the design, manufacture, and support of advanced electric underwater robotic systems. It serves multiple sectors including oil and gas, renewable energy, marine science, aquaculture, and defence.	- Aquaculture - Marine science - Energy	Ref
85	Samudra	UK	Samudra uses robotics and AI to help scale and automate seaweed farms. It produces a modular solution, called NIRA, for monitoring conditions and providing data feedback to farmers using terrestrial or satellite communications.	- Aquaculture - Environmental monitoring	Ref
86	Satellogic	Uruguay	Founded in 2010, Satellogic operates a vertically integrated business model to provide high-resolution, high-frequency satellite imagery and geospatial data that users can subscribe to. It has launched 43 satellites and plans to launch another 90.	- Energy and mining - Government and defence - Finance and insurance - Environment and climate	Ref
87	Sea-Bird Scientific	US	Formed from three separate companies in 2011, Sea-Bird Scientific is one of the world's largest developers and manufacturers of products for monitoring ocean conditions. It not only develops and builds sensors, but also oversees sensor calibration in scientific studies.	- Marine monitoring - Aquaculture	Ref
88	Syrenna	Norway	Syrenna collects, processes, and visualises data from its autonomous underwater vehicles named WaterDrones. Founded in 2022, the company is a result of a four-year research project at Oslo Metropolitan University's Oceanlab.	- Marine monitoring - Marine research	Ref
89	Teledyne Marine	US	Teledyne Marine, a division of Teledyne Technologies, was founded in 1962 to provide underwater technologies to the marine exploration, research, defence, and industrial sectors. The core capability is monitoring, ranging from imaging to hydrographic measurements.	- Marine research - Defence - Environmental monitoring	Ref
90	WSense	Italy	WSense is a spin-off of Sapienza University of Rome, specialising in monitoring and communication systems to enable the Internet of Underwater Things (IoUT). It was founded in 2012 and provides cableless networking interoperability among various vendors of underwater sensors and autonomous vehicles.	- Marine monitoring - Marine research	Ref
91	XpertSea	Canada	XpertSea offers aquaculture health monitoring and management solutions powered by AI. It is targeted at the seafood industry, specifically farming and trading. Typically, it advises farmers on modernising operations and providing access to fast payment methods.	- Aquaculture - Fisheries - Food industry	Ref
92	YSI	US	YSI is part of Xylem Analytics, a global company focused on water quality and ocean health monitoring. It provides monitoring and sampling tools for aquaculture and ocean health testing, with portable and laboratory instrumentations available.	- Aquaculture - Water quality monitoring	Ref

Aquaculture

ID	Organisation	Location	Company overview	Target markets	Ref
93	AquaSignum	Canada	AquaSignum provides insight into aquatic environments with real-time microbial monitoring. Founded in 2019 by environmental microbiologists, it primarily focuses on industrial and municipal water issues. Its work began as a lab-based tool that it then spun out commercially.	- Environmental microbiology - Water-quality monitoring - Waste-water treatment - Food and beverage	Ref
94	Benthic Solutions	UK	Benthic Solutions is a marine environmental consultancy targeted at the assessment, restoration, and conservation of marine ecosystems. It has carried out surveys, analytics, and project management for the marine industry since 2004.	- Marine conservation	Ref
95	FREDsense Technologies	Canada	Founded in 2014, FREDsense Technologies is a provider of biosensing solutions for water quality monitoring and remediation. The company emerged from the University of Calgary's iGEM (International Genetically Engineered Machine) team, using genetically engineered bacteria to detect contaminants in water.	- Water quality monitoring	Ref
96	Fugro	Netherlands	Fugro was founded in 1962 and is a large geotechnical, geodata and geosurvey company, offering services to clients in 57 different countries, across industries including construction, infrastructure and maritime.	- Geotechnical surveying - Data analysis	Ref
97	Huawei / Tech4Nature	China	Huawei is a large telecommunications company headquartered in China, which develops, manufactures and sells a wide range of telecommunications equipment, and is one of the largest smartphone manufacturers in the world. It has previously engaged in marine survey studies.	- Telecommunications	Ref
98	MMC First Process	Norway	MMC First Process is a system integrator company applying the concepts and technologies of industrial automation to fishing handling, land-based aquaculture, biomass security and sustainable aquaculture. The company dates back to 1985 when MMC started the delivery of handling equipment to fishing boats.	" Industrial automation - Agriculture - Aquaculture	Ref
99	Ocean Alchemists	US	Ocean Alchemists designs ointments for marine life, including a specific CoralCure ointment for stony corals. It supplies dive strike teams with its formulations and has worked with teams across The Cayman Islands, Honduras, Puerto Rico, and Jamaica.	- Coral reef restoration - Marine conservation	Ref
100	Ocean Optics	US	Florida-based company Ocean Optics offers spectroscopy and sensing solutions for many applications, including for environmental monitoring in marine ecosystems. Rather the provide high-end laboratory equipment with a focus on precision, Ocean Optics instead produces compact, robust, affordable, and easy-to-use spectroscopy equipment that is well-suited for field deployment.	- Environmental monitoring - Academic research - Established company - Quality control	Ref
101	Regional Fish Institute	Japan	Regional Fish Institute is an academic-based startup that derived from Kyoto University. The startup utilizes genome editing technology and full-cycle aquaculture to shorten the breed improvement process from 30 years to only 2-3 years.	- Aquaculture	Ref
102	Seatrec	US	Seatrec builds thermal energy harvesting systems which generate electricity from ocean temperature differences. Founded in 2016, it is a Californian company originating from NASA's Jet Propulsion laboratory. It receives funding from private investors, government grants, and industry contracts.	- Environmental monitoring - Marine research	Ref
103	OTAQ	UK	Established UK-based marine technology company OTAQ was founded in 1997. It delivers and supports marine technology products for applications ranging from aquaculture to offshore energy. Technologies include underwater cameras accompanied by image analysis software.	- Aquaculture - Environmental monitoring - Oil and gas - Underwater communications	Ref
104	Alltech	US	Originally established as a small feed additive company in Lexington, Kentucky, Alltech has since expanded its reach to over 120 countries, with operations spanning across agriculture, aquaculture, pet food, and food production industries.	- Aquaculture - Animal feed	Ref
105	AquaBioTech Group	Malta	AquaBioTech is an international consulting company that undertakes projects on aquaculture developments, market feasibility studies, and technology sourcing. It has experience in aquatic nutrition research testing new formulations and ingredients in fisheries.	- Aquaculture - Animal feed - Fisheries	Ref
106	Aquaforest	Poland	Aquaforest offers a wide range of chemical and biological (probiotic) products that support coral growth. Founded in 1995, it initially manufactured substrates and aquatic fertilisers for zoos, aquariums, and plant farms. Since, it has moved into fish and coral farms.	- Aquaculture - Aquarists - Fisheries	Ref
107	Aquanzo	UK	Aquanzo is a marine protein farming company, originating in 2021. It farms zooplankton and brine shrimp on land, to then deliver ingredients to the aquaculture industry. It was one of 15 startups selected for the 2022 Nutreco Feed & Food Challenge.	- Aquaculture - Animal feed	Ref
108	Ecological Laboratories	US	Based in Florida (US), Ecological Laboratories is a biotechnology company developing and manufacturing water treatment solutions and liquid microbial formulations. It aims to improve the sustainability of both waterways and agricultural land.	- Waste water management - Agriculture - Aquaculture	Ref
109	Fauna Marin	Germany	Fauna Marin is a company specialising in coral food, water treatment, and marine aquarium products. It sells glues, food, water tests, and equipment cleaners. It has been active in farming corals on a professional level since 2001.	- Aquarists - Reef keeping - Aquascaping	Ref
110	Life-Space	Australia	Life-Space is one of the most popular probiotic brands in Australia, specialising in nutrition, microbiomes, and bacteria. It has partnered with the Great Barrier Reef Foundation on a probiotic and feeding technique for coral.	- Medicine - Healthcare - Food - Wellness	Ref
111	NCIMB	UK	NCIMB is a Scottish biotechnology research company. It provides microbiology, analytical, and biological material storage services, possessing the UK's largest bacterial reference strain library. Despite no direct experience with coral, it has worked with marine bacteria.	- Life sciences - Food - Marine sciences - Environmental sciences	Ref
112	Novozymes	Denmark	Novozymes develops a range of microbial solutions and enzyme products aimed at enhancing environmental health. These products are designed to improve water quality, degrade pollutants, and promote beneficial microbial activity.	- Aquaculture - Animal feed - Healthcare	Ref
113	Nyos	Germany	Nyos specialises in equipment and products for aquarists. Founded in 2015, the company's product line includes protein skimmers, reactors, additives, and other equipment designed to maintain optimal aquarium water quality.	- Aquascaping - Coral care - Aquariums	Ref

Aquaculture

ID	Organisation	Location	Company overview	Target markets	Ref
114	Red Sea Fish	US	Red Sea Fish was founded over 30 years ago and has a dedicated team of scientists and aquarists who develop complete reef solutions and nutrition for reef keeping and maintenance. Its main target is aquarists and reef-keepers.	- Aquarists - Reef keeping - Aquascaping	Ref
115	Seed Health	US	Seed Health is a microbial sciences company founded in 2015, specialising in novel therapeutics, consumer health, and environmental solutions. It constructs proprietary biotherapeutics across paediatric care, nutrition, dermatology, and even environmental immunity such as protecting honey bees.	- Life sciences - Probiotics	Ref
116	Skretting	Norway	Skretting is a nutritional solution company for the aquaculture industry, formulating specific nutrient ratios. It has production facilities on five continents and manufactures and delivers high-quality feeds from hatching to harvest for more than 60 species.	- Aquaculture - Animal feed	Ref
117	Triton	Germany	Triton is a supplier of aquarium biochemicals and laboratory testing for closed reef systems, with marine and chemical scientists developing its procedures. Its target market includes both hobbyists and large operations, such as public aquaria, research facilities, or environmental regulators.	- Aquarists - Reef keeping - Aquascaping	Ref
118	Tropic Marin	Switzerland	Tropic Marin, founded in 1964, is involved in the breeding of and research into marine organisms. It mainly focuses on sea salts, minerals, and supplements essential for maintaining environments.	- Aquarists - Reef keeping - Aquascaping	Ref
119	Autodesk	US	Autodesk is a multinational software corporation, specialising in AI-powered robotics. While its primary target market is not coral conservation, it is working with Coral Maker to automate its coral translocation efforts.	- Architecture - Engineering - Manufacturing	Ref
120	BMT Group	UK	BMT is a maritime-oriented design house and technical consulting firm formed in 1985. It provides services across maritime design, asset monitoring, environmental solutions, and defence and security. It is involved from initial concept through to design, construction, operation, and eventual decommissioning.	- Maritime industries - Fisheries - Defence - Coastal conservation	Ref
121	Korai	France	Korai was originally a coral farm, and rebranded in 2020 to focus on sustainability. It offers business advice to companies wanting to create a biodiversity strategy, runs restoration projects, and creates biodiversity reports.	- Coral reef restoration - Environmental consulting	Ref
122	McLaren	UK	McLaren is a British luxury automotive manufacturer based at the McLaren Technology Centre in Woking, England. The main products of the company are sports cars, which are produced in-house in designated production facilities.	- Coral reef restoration	Ref
123	Ocean Revive	Saudi Arabia	Ocean Revive is a King Abdullah University of Science and Technology (KAUST) startup aimed at coral restoration. The company designs 'maritechture' systems to streamline coral transplantation. The project was the subject of a 2023 VICE documentary.	- Coral reef restoration	Ref
124	ORA	US	ORA (Oceans, Reefs & Aquariums) is an aquaculture company specialising in the sustainable breeding of marine ornamental fish and corals. It provides high-quality, captive-bred specimens to the aquarium trade, promoting conservation and reducing the need for wild species collection.	- Aquarists - Reef keeping - Aquascaping	Ref
125	Reefscapers	Maldives	Reefscapers is a marine consultancy company working to restore coral reefs in the Maldives since 2005. Targeted primarily at island-based resorts to improve the health and longevity of coral reefs for tourism, Reefscapers offers a propagation programme with continuous monitoring, maintenance, and support.	- Tourism	Ref

Biotechnology

ID	Organisation	Location	Company overview	Target markets	Ref
126	Applied Genomics	UK	Applied Genomics is a UK-based consultancy specialising in eDNA analysis and molecular ecology. Its technology has been applied to quantify the environmental impacts of offshore marine structures, assets, and infrastructure on marine ecosystems.	- Aquaculture - Oil and gas - Ports and shipping - Agriculture - Forestry	Ref
127	eDNAtec	Canada	eDNAtec is an environmental genomics company, aimed at analysing biodiversity in offshore, onshore, and terrestrial ecosystems. It works with companies in energy, mining, commercial fisheries, aquaculture, as well as indigenous communities.	- Environmental services - Biodiversity monitoring	Ref
128	EnviroDNA	Australia	EnviroDNA launched in 2016. It delivers eDNA services to monitor aquatic and terrestrial environments for areas such as conservation, biosecurity, impact assessments, and research. The company was spun out of sister-company Cesar Australia, a research service.	- Environmental services - Biodiversity monitoring	Ref
129	NatureMetrics	UK	NatureMetrics is a global nature intelligence company founded in 2014, that provides nature monitoring solutions. The company's flagship product is eDNA, but it also offers sediment analysis and nature strategy advisory services.	- Biodiversity monitoring - Environmental services	Ref
130	Ocean Diagnostics	Canada	Ocean Diagnostics was founded in 2017 as a 'not-just-for-profit' enterprise with the aim of improving ocean health. It develops technology for collecting data marine microplastics and eDNA, to allow for informed decision-making surrounding ocean conservation.	- Environmental services - Biodiversity monitoring	Ref
131	Oxford Nanopore Technologies	UK	Oxford Nanopore Technologies was founded in Oxford in 2005, and focuses on using nanopores for the real-time analysis of DNA, RNA, and proteins. Its technology is used across the globe in a diverse range of fields, from environmental monitoring to cancer research.	- DNA sequencing - Life sciences	Ref
132	Stantec	Canada	Stantec is a multinational design services company, founded in 1954, with over 450 locations worldwide. Included in its product offering is eDNA monitoring, which has been used to study salamanders in Canada.	- Environmental services	Ref
133	The Biodiversity Consultancy	UK	The Biodiversity Consultancy (TBC) was founded in 2006 by a team of environmental data scientists, system architects, and sustainability practitioners. It offers technical expertise, policy advice, and field capacity. One of its target markets is marine risk management.	- Financial services - Renewable energy - Mining - Agriculture - Marine	Ref
134	Bento Lab	UK	Bento Lab creates portable PCR workstations for scientists to work in remote locations. Established in 2013, its equipment is designed to be affordable, compact, and customised depending on volume needs. The company provides workflow guides for users.	- Life sciences - Research - Genomics	Ref
135	Afekta Technologies	Finland	Afekta Technologies is a metabolomics service provider specialising in microbiota-associated compounds and bioactive phytochemicals present in plant-based foods. It is primarily targeted at food manufacturing but also provides services for healthcare and academia.	- Food - Healthcare - Biotech	Ref
136	AquaGen	Norway	AquaGen, founded in 1992 and headquartered in Norway, is an aquatic genetics company, specialising in the selective breeding of salmon and trout. AquaGen employs genomic technologies to improve growth rates, disease resistance, and overall fish health.	- Aquaculture - Animal breeding	Ref
137	Benchmark Genetics	Norway	Benchmark Genetics is a provider of genetic improvement programs for aquaculture species. The company focuses on breeding and genetic technologies to improve traits such as disease resistance, growth rates, and environmental adaptability in various fish and shellfish species.	- Aquaculture	Ref
138	Coral Spawning Lab Ltd	UK	The Coral Spawning Lab consists of a small team of researchers who study the way coral reproduce and seek to recreate this process. It also provides design advice and training to aquariums globally. Its team has over 50 years of coral husbandry, scientific research and aquarium manufacturing experience.	- Aquaculture - Coral spawning - Coral reef restoration	Ref
139	Evogene	Israel	Evogene was established in 2002, and it uses computational predictive modelling for product discovery and development. While it has no marine experience, the technology can be applied to microbes, small molecules, and genetic elements.	- Agriculture - Healthcare	Ref
140	GC Lipid Tech	Canada	GC Lipid Tech specialises in creating genetically modified microalgae for sustainable aquafeed, including fish feed pellets. Leveraging its expertise in genetic engineering, the company designs microalgae strains with specific qualities.	- Biofuel - Healthcare - Food industry	Ref
141	Hendrix Genetics	Netherlands	Hendrix Genetics works on animal breeding and genetics, operating across poultry, swine, and aquaculture. It focuses on breeding stock, trait selection, disease resistance and selective breeding. Every Hendrix Genetics brand has its own breeding program. Each is tailored to its market.	" Aquaculture - Animal breeding	Ref
142	Illumina	US	Illumina is an American biotechnology company, founded in 1998. Illumina develops array-based life sciences technologies for DNA and RNA sequencing to enable research discovery and personalised health solutions. Its technology could be applied to marine organisms as well as healthcare applications.	- Life sciences - Research - Genomics	Ref
143	Inari	US	Inari is a US-based biotechnology research company focusing on seed and plant genetics. Since 2016 it has used genomics, AI, and a patented gene editing technology for improvements in crop yield and resource use efficiency.	- Agriculture - Food industry - Crops	Ref
144	Inscripta	US	Inscripta is a life science technology company, utilising genome engineering for biomanufacturing and biotech. It has no direct experience with coral conservation, but the type of technology it provides has been used with CRISPR and corals.	- Life sciences - Research - Genomics	Ref
145	Integrated DNA Technologies	US	Integrated DNA Technologies is a global biotechnology organisation providing advanced, custom nucleic acid solutions. It supports CRISPR and PCR techniques through manufacturing oligonucleotides, the components of DNA and RNA. It has no experience with marine conservation.	- Life sciences - Healthcare - Medicine	Ref
146	Macrogen	Republic of Korea	Founded in 1997 and based in Seoul, Macrogen is a global digital healthcare company. It provides DNA sequencing and analysis services. It claims its services are agnostic to sample type. It offers CRISPR, gene synthesis, proteomics, and microarray services.	- Healthcare - Biotech	Ref
147	Metabolon	US	Metabolon is a global leader in metabolomics research aimed at the life sciences and drug development industries. Founded in 2000, it has conducted more than 10,000 independent and collaborative studies, resulting in 2,000+ publications in leading peer-reviewed journals.	- Life sciences - Drug development	Ref
148	Pacific Biosciences (PacBio)	US	California-based biotechnology company Pacific Biosciences (PacBio) was founded in 2004 to commercialise single-molecule real-time DNA sequencing. This technology has been applied to research in evolutionary biology, cancer research, and personalized medicine.	- Healthcare - Biotechnology - Biological observation	Ref

Biotechnology

ID	Organisation	Location	Company overview	Target markets	Ref
149	Phycoil Biotechnology	US	Phycoil is a biotechnology company, founded in 2009, that manufactures plant-based omega-3 nutritional supplements using platform technology for strain collection, optimisation and synthetic biology. It converts microalgae into animal feed, and supplements for livestock and aquatic animals.	- Cosmetics - Healthcare - Aquaculture	Ref
150	Synthego	US	Founded in 2012, Californian startup Synthego specialises in CRISPR-based genome engineering solutions. The company combines proprietary hardware, software, bioinformatics, chemistries, and molecular biology for basic research, target validation, and clinical trials. The main application is providing cell and gene therapies.	- Healthcare - Biotechnology	Ref
151	Tropic Biosciences	UK	Tropic Biosciences was founded in 2016. The company focuses on developing high-performing crop varieties, particularly bananas, coffee and rice, using gene-editing technologies, to achieve resistance to diseases and environmental stressors.	- Agriculture - Food industry	Ref
152	Xelect	UK	Xelect started as a spin-out from a leading aquaculture research group at the University of St Andrews in 2012. From its custom-built laboratories in St Andrews, it manages broodstock and genetic improvement programmes for major aquaculture producers all around the world.	- Aquaculture	Ref
153	Algenol	US	Algenol is a global, industrial biotechnology company that produces ethanol, biofuels, proteins, and colourants. Founded in 2006, it operates using strain selection and offers customised scaling and manufacturing approaches.	- Biofuel - Healthcare - Food industry	Ref
154	Algenuity	UK	Algenuity is a UK-based biotechnology company founded in 2009. Its focus is on developing photobioreactors and other solutions for efficient algal cultivation. Algenuity's technology supports industries including, food, animal feed, and biofuels.	- Biofuel - Agriculture - Animal feed - Food industry	Ref
155	Algiecel	Denmark	Algiecel produces proteins and omega-3s from captured industrial CO_2, microalgae, and photobioreactor technology. It provides a high-yield reactor fitted into standard shipping containers and ingredients for aquaculture feed and pet food.	- Agriculture - Food industry - Cosmetics	Ref
156	Carbon Biocapture	US	Founded in 2019, Carbon BioCapture capitalises on Clean Energy ESB S.A.'s patented technology with flue gases by developing, building, deploying, and operating point-source carbon capture farms. These farms convert anthropogenic CO_2 into microalgae biomass.	- Biofuel - Healthcare - Food industry	Ref
157	Cellana	US	Cellana is a bioproducts company that specialises in the production of algae-based products for industries including animal nutrition, human health, and biofuels. Founded in 2007, Cellana leverages cultivation technologies to produce microalgae rich in omega-3 fatty acids, proteins, and other essential nutrients.	- Animal feed - Biofuel	Ref
158	Chitose Group	Singapore	Chitose Group is a family of biotechnology research companies. It focuses on microorganisms, algae, cell lines, and microbiota. It began as a laboratory corporation in 2004.	- Life sciences - Fuel development	Ref
159	Global Algae Innovations	Hawaii	Global Algae was founded in 2013, specialising in leveraging algae in food and fuel production. It focuses on cultivating, harvesting, and processing algae as well as lowering the cost and energy demands of such processes.	- Fuel development - Healthcare	Ref
160	Lgem	Netherlands	Lgem produces photobioreactor systems for cultivating microalgae at any scale. It has 15 years of experience in building systems and growing algae. It specialises in strain and species selection, temperature and fertiliser scheduling, consultancy, and contract manufacturing.	- Research - Microalgal production	Ref
161	MicroBio Engineering	US	MicroBio Engineering is a microalgae biotechnology company focusing on developing near- to mid-term algae-based wastewater treatment, renewable energy, and animal feed production systems. It provides custom feasibility analyses for projects to help determine commercial pathways.	- Aquaculture - Animal feed - Biofuels - Wastewater treatment	Ref
162	Mitsubishi Kakoki Kaisha	Japan	A part of the global Mitsubishi Group, Mitsubishi Kakoki Kaisha (MKK) focuses on the engineering and construction of industrial plants and equipment. It was founded in 1935 and manufactures high-performance industrial machinery.	- Medicine - Food - Water treatment - Shipping	Ref
163	Phycom	Netherlands	Phycom is a food and beverage manufacturing company utilising microalgae cultivation and production. Founded in 2009, it produces algae flakes in a fine powder aimed at animal feed including fish, as well as in juices, bakery products, and food supplements for humans.	- Agriculture - Food industry - Aquaculture	Ref
164	PhycoWorks	UK	PhycoWorks was founded in 2021, using synthetic biology and AI to develop waste algae for use as a feedstock for renewable chemicals and materials production. Its technology enhances specific strain performance, indicating crossover for seeding.	- Biofuel - Food - Pharmaceuticals - Manufacturing	Ref
165	Redono	Finland	Redono was founded in 2017 and seeks to market sustainable methods of microalgal growth that can be incorporated into the preexisting carbon cycle. Its main market is not coral conservation, but it has developed technologies for farming specific algae strains.	- Biofuel - Brewing industry	Ref
166	SunOleo	France	SunOleo, founded in 2016, specialises in developing advanced photobioreactors for the industrial cultivation of microalgae, focusing on applications such as biomass production, carbon sequestration, and nutrient management.	- Algae cultivation - Biofuel - Food	Ref
167	Viridos	US	Viridos (formerly Synthetic Genomics, Inc) is a privately held biotechnology company harnessing algal genetics to produce low-carbon intensity biofuels and specific algal strains.	- Biofuel - Agriculture	Ref

Environmental mitigation

ID	Organisation	Location	Company overview	Target markets	Ref
168	Arbon Earth	Sweden	Arbon Earth, founded in 2021, is a carbon dioxide removal company utilising fast-growing bamboo and specific algae to remove carbon from the atmosphere. Clients pay for Arbon Earth to manufacture an Oceanpod that promotes algae growth prior to sinking, sequestering carbon.	- Environmental services - Marine conservation - Carbon offsetting	Ref
169	Terraformation	US	Terraformation helps forestry teams and local communities launch restoration projects as a carbon capture solution. It has a 'Seed to Carbon Forest Accelerator' to equip early-stage projects with training and software, which will have downstream impacts on marine life.	- Forestry - Environmental consulting	Ref
170	ACD Pharma	Norway	ACD Pharma is a Norwegian startup focusing on the use of bacteriophages against antibiotic-resistant pathogenic bacteria. With initial success in aquaculture for the treatment of farmed fish pathogens, it is now expanding to human health also.	- Aquaculture - Fisheries - Life sciences - Healthcare	Ref
171	AtSeaNova	Belgium	AtSeaNova was founded in 2016 and provides consultancy, training, installation, juveniles, substrates, and tools to begin industrial seaweed cultivation. It currently has R&D projects focusing on installing seaweed farms into windmill parks, and optimising biomass-based molecules for food and feed.	- Improving ocean water quality - Seaweed farming	Ref
172	Australian Seaweed Institute	Australia	Australian Seaweed Institute develops seaweed biofilters to offset ocean pollution. Founded in 2020, it is currently government-funded but is establishing its product offering. It aims to create a network of filters across the Great Barrier Reef.	- Reef conservation - Improving ocean water quality	Ref
173	Azul Bio	US	Azul Bio creates coral microbiome boosters (CMBs) that provide coral reefs immunity from heat stressors and disease. It offers end-to-end genomic and microbiome analysis services for marine industries operating in aquariums and the wild.	- Aquaculture - Aquarists	Ref
174	John Deere	US	John Deere is a well-established 186 year old agritech company transitioning from primarily supplying hardware for farming to integrating automation and robotics into its products to improve efficiency.	- Agriculture	Ref
175	Marine BioEnergy	US	Marine BioEnergy, founded in 2016, cultivates kelp. The company uses open ocean kelp farms and dynamic marine permaculture arrays which are designed to sequester carbon dioxide. This can be deployed in deep waters to optimise growth conditions and the harvested seaweed can be repurposed into biofuels.	- Environmental services - Marine conservation - Improving ocean water quality	Ref
176	NexaBiome	UK	NexaBiome is a biotechnology company focusing on the application of bacteriophages for health & disease. Specialising in human health, its technology platform develops custom phage therapies which could be used in marine environments.	- Medicine - Life sciences - Healthcare	Ref
177	EcoSPEARS	US	EcoSPEARS, founded in 2017, is an environmental technology company specialising in the removal and destruction of persistent organic pollutants from contaminated sediments, soils, and groundwater. It has a growing focus on applications that protect and rejuvenate critical habitats such as coral reefs.	- Improving ocean water quality - Environmental services	Ref
178	Equatic	US	Equatic was founded in 2021 and focuses on carbon capture and green hydrogen production using an electrolytic process that enhances ocean alkalinity, capturing atmospheric CO_2 in stable forms. It designs, develops, commissions, co-owns and co-operates carbon removal plants around the world.	- Environmental services - Marine conservation	Ref
179	Garrison Minerals	US	Garrison Minerals produces magnesium materials. It was founded in 2008 and has a large R&D branch investigating battery metal recovery, acid mine drainage, and nuclear waste disposal. It has collaborated on projects to counteract ocean acidification.	- Pharmaceuticals - Wastewater treatment - Marine exhaust mitigation	Ref
180	ABB	Switzerland	ABB is a leading provider of robotic systems, especially for machine automation, along with the accompanying digital systems. It provides equipment for a very wide variety of industry sectors, spanning from construction to healthcare and from mining to power generation.	- Manufacturing - Utilities - Automotive - Construction - Food and beverage	Ref
181	Blue Carbon	Australia	Blue Carbon designs and build large 'oPods' for ocean water pumping focusing on mitigating climate change, reviving marine ecosystems, and supporting sustainable aquaculture. It was founded in 2021 and is currently engaged with the Australian Institute of Marine Science.	- Aquaculture - Environmental engineering - Coral reef restoration	Ref
182	Blue Eco Line	Italy	Blue Eco Line is a small Italian company founded in 2020, providing automated solutions for removing plastic from rivers and analysing the waste. It claims its services are carbon neutral and equipped for remote monitoring.	- Waste management	Ref
183	CCell Renewables	UK	CCell was founded in 2015, developing technologies to enable marine environments to be measured, analysed, and protected. It designs and installs digitised reefs to protect coastlines from erosion and restore habitats.	- Coastal protection - Coral reef restoration	Ref
184	Clearbot	Hong Kong	Clearbot began as a student project in 2019, looking to aid marine rubbish collection in Indonesia. It produces small autonomous boats designed for urban waterways that target pollution recovery, surveillance, rescue, and cargo delivery.	- Waste management - Tourism	Ref
185	Deep Trekker	Canada	Deep Trekker is a manufacturer of remotely operated underwater vehicles (ROVs). It is based in Canada and was founded in 2010. Deep Trekker's systems are utilised across industries including aquaculture, marine research, environmental monitoring, infrastructure inspection, and search and rescue.	- Aquaculture - Marine research - Environmental monitoring - Infrastructure inspection	Ref
186	Ebb Carbon	US	Ebb Carbon is a climate technology startup founded in 2021, focusing on ocean-based carbon dioxide removal. Its pilot plant removes 100 tonnes of carbon dioxide annually, with plans to deploy a 1,000 tonne system soon.	- Aquaculture - CO_2 removal	Ref
187	Ecocoast	Dubai	Ecocoast provides engineering solutions for the protection of coastlines and waterways. The company has been manufacturing since 1998, providing safety booms, barriers, and buoys for navigation and mooring.	- Coastal protection - Aquaculture	Ref
188	EvoLogics	Germany	Founded in 2000, EvoLogics is an R&D focused company that offers technologies for multiple underwater communication, positioning, navigation and monitoring applications. Many of its technologies are inspired by the natural world, for example the underwater communication of dolphins.	- Fisheries - Marine science - Energy	Ref

Environmental mitigation

ID	Organisation	Location	Company overview	Target markets	Ref
189	Ichthion	UK	Ichthion is an academic spin out from Imperial College London since 2017. Its barrier and filter technology removes macro and microplastic from rivers and oceans. The company was awarded an Innovate UK grant in 2018.	- Waste management - Improving ocean water quality - Governments	Ref
190	Ocean Therm	Norway	OceanTherm is a Norwegian startup working to mitigate the formation of tropical cyclones by re-deploying bubble curtains typically used for keeping fjords free of ice. The company was founded in 2017 with a goal of minimising the casualties that can follow tropical storms.	- Coastal protection - Environmental engineering	Ref
191	Origin by Ocean	Finland	Origin by Ocean is an algae refining company aimed at removing harmful algae and limiting eutrophication. It removes marine overgrowth and transforms it into ingredients for everyday consumer products. It employs fishermen, boat operators, and other potential algae harvesters.	- Marine conservation - Agriculture - Consumer products	Ref
192	Ørsted	Denmark	Ørsted is a Danish engineering firm focused on the development, construction, and operation of renewable energy projects, including wind, solar, and green hydrogen. It is the largest producer of energy in Denmark and was the first company in the world to have its science-based net-zero emissions target validated by the Science Based Targets initiative.	"- Coastal protection - Coral reef restoration	Ref
193	Planetary	Canada	Planetary was founded in 2019 by an Ocean Alkalinity Enhancement researcher to provide the safe addition of antacid to seawater. Planetary is in the test stages of several carbon removal projects, having received pre-seed and seed funding in 2022.	- Wastewater treatment - Power plant cooling - Marine restoration	Ref
194	Qysea	China	Qysea Technology is a global enterprise that researches and develops professional underwater robots and their supporting equipment. It was founded in China in 2016 and is committed to delivering exceptional expertise in the R&D, manufacturing, and sales of underwater robots.	- Aquaculture - Underwater inspection	Ref
195	Reef Arabia	Bahrain	Reef Arabia, based in Bahrain, was established in 2012 as the region's first provider of a wide range of artificial reef units, including both licensed 'Reef Ball' units and unique manufactured designs. The company works with marine biologists to install and monitor these structures and systems.	- Coral reef restoration	Ref
196	Reefgen	US	Reefgen is a small US company founded in 2019 and is focused on developing automated coral planting systems. It has a RaaS (robots as a service) business model. It received a US government grant in 2021 to develop the technology for this purpose, and is an extension of a venture capital studio.	- Coral reef restoration	Ref
197	Sonardyne	UK	Founded over 50 years ago, Sonardyne International provides underwater technology, focusing on subsea navigation, positioning, and data transfer. Its capabilities include development, manufacturing, and support.	- Energy - Defence - Marine science	Ref
198	SOS Carbon	Dominican Republic	SOS Carbon is a spinout from the mechanical engineering department at Massachusetts Institute of Technology to tackle the twin problems of sargassum overgrowth, due to water pollution and higher ocean temperatures, and carbon sequestration. It has over 30 local and international partners as of 2024.	- Marine conservation	Ref
199	Thalasso Ocean	Norway	Thalasso is a Norwegian-Mexican startup developing autonomous drones and micro biorefineries to harvest and extract valuable products from sargassum in the Caribbean Sea, with the aim of 'turning a problem into an opportunity'.	- Improving ocean water quality	Ref
200	The Great Bubble Barrier	Netherlands	The Great Bubble Barrier was founded in 2017 to stop plastic pollution being transported through freshwater systems in the Netherlands and into the world's oceans, with rivers being responsible for adding ≈3Mt of plastic pollution into the marine ecosystem every year.	- Government - Maritime	Ref

Abbreviations

CORDAP	Coral Research & Development Accelerator Platform
AI	Artificial intelligence
eDNA	Environmental DNA
ROV	Remotely operated underwater vehicle
AUV	Autonomous underwater vehicle
IP	Intellectual property
ESG	Environmental, Social, Governance

Glossary

Biomimicry	The design and production of materials, structures, and systems that are modelled on biological entities and processes.
Coral recruitment	The addition of new individuals to populations, often onto new substrate materials.
Sequestration	The process of capturing and storing atmospheric carbon dioxide, which can be either geological or biological.

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