



Ocean Ambassadors

The value of the ocean environment
to the economy and businesses

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Foreword

There is widespread recognition that business-as-usual is not sustainable if humanity is to stand a chance of tackling climate change, decarbonising our economies and reversing biodiversity loss. The urgency of the crisis we face is hard to comprehend and is compounded by a clear sense that the steps being taken are not enough.

One of the major reasons for our lack of progress is that, as a land species, our thoughts, like our feet, are too often rooted to the soil. We are grounded in our thinking, and this has consequences in terms of where our money is invested, and action is concentrated, to reverse climate breakdown.

In conservation terms, this narrow thinking corresponds to an appalling lack of understanding of and protection for our waters. The ocean and its ecosystems are fundamental to life on earth: they are our life support system. They have given us the air we breathe, regulate our climate and weather, feed us, and bring us joy. And yet the ocean which connects us is all too often ignored when governments and industries consider what steps they can take to mitigate our greatest emergency.

Marine ecosystems are deteriorating at an alarming rate, and this has huge consequences to us as individuals and our businesses. This report aims to raise awareness of the significant benefit marine ecosystems provide and highlights the role that whales and dolphins (cetaceans) have as “Ocean Ambassadors” by showing the significant ecological contribution they make and value they bring.

‘Value’ in this sense does not relate to the monetary price of whales and dolphins. The difference between price and value is vast. True value factors in the current and future benefit that animals bring through their natural cycle of life and death. Deloitte and WDC encourage everyone to view nature through eyes which see beyond the price of commodities. As this report demonstrates, the value of whales and dolphins living and thriving in the wild is beyond what humans have previously viewed only as price tags on dead animals; the value of living nature is immense.

Our message is clear: we cannot beat the climate and biodiversity crises without protecting the ocean, and we cannot protect the ocean without whales and dolphins. For humanity to have a chance to overcome these dual emergencies, businesses and industries must appreciate the responsibilities they have to help ocean nature thrive when making economic decisions.

The truth is that we are running out of time. However, there are huge opportunities for public and private sector organisations to collaborate and tackle the degradation of marine ecosystems, by providing investment and leveraging existing data collection mechanisms alongside new, exciting developments in advanced analytics. Acting now to save whales, dolphins and our ocean not only makes environmental sense, but this report also shows that it makes good business sense too.

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The ocean and its ecosystems are an essential part of our planet, yet they're overlooked and being depleted at alarmingly high rates.

This report aims to raise awareness by using cetaceans as a theme and outlining a holistic framework to value living species and ecosystems.

Businesses face increased scrutiny on their impacts on biodiversity loss and ecosystem degradation. This creates a fast-moving business landscape that presents both risks and opportunities.

This report casts a spotlight on four selected sectors

- 🍷 Food Retail
- 🌐 Tourism
- 🚢 Shipping
- 💰 Finance

Cetaceans support biodiversity and biomass



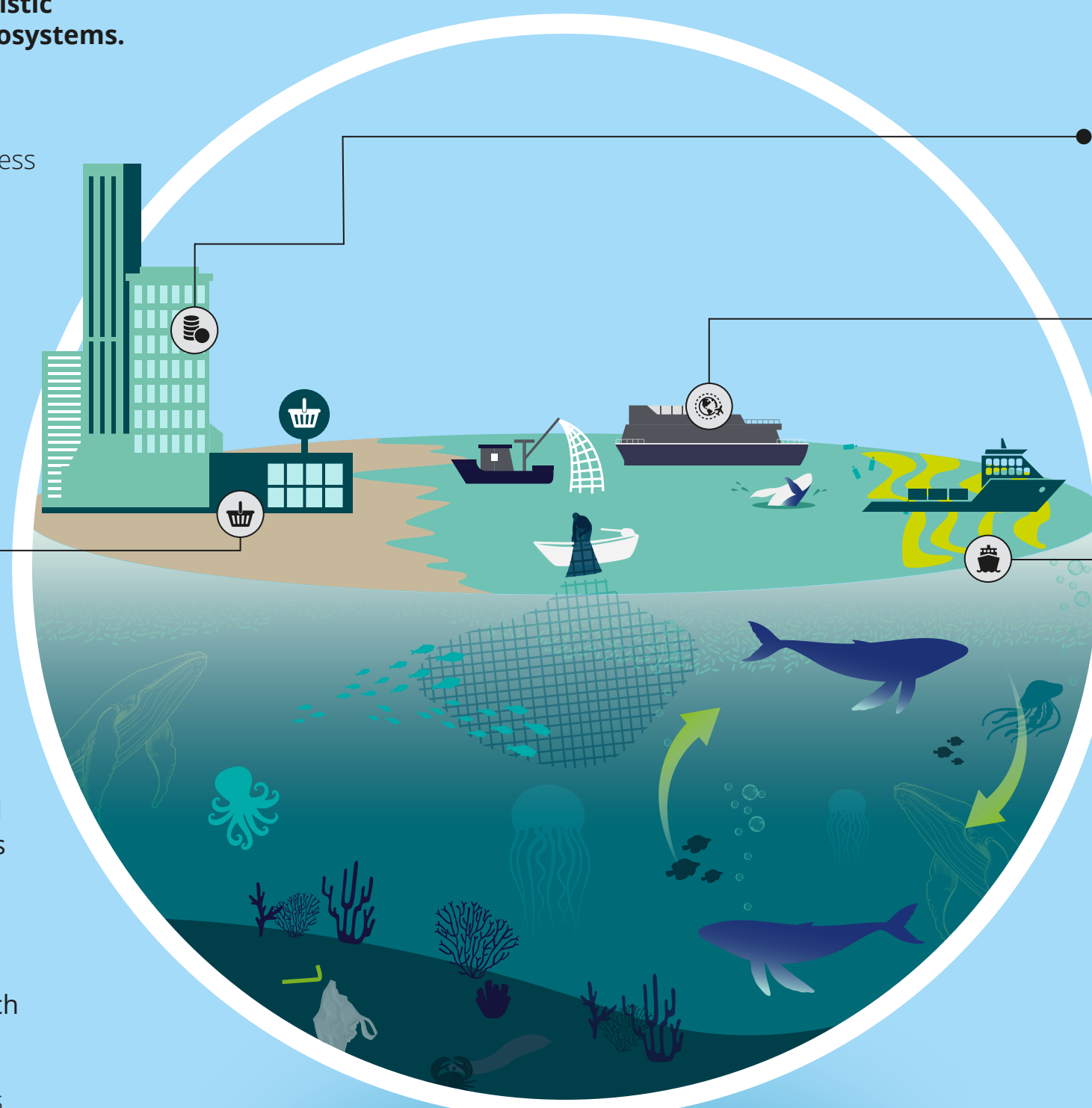
Blue whales can ingest up to 43kg of microplastics each day.

It is estimated that each blue whale off Brazil contributes £300,000 to commercial fisheries over its lifetime. Despite benefits,

300,000

cetaceans are killed per year through bycatch

One key challenge is the general lack of data. However, this should not stop positive actions being made, which are explored in this report.



1%
of all climate finance goes to the ocean

Financial levers (such as investment and insurance) can influence activity in other sectors, indirectly impacting ocean health.

Whale watching contributes **£3.1bn** to the global economy.

This is estimated to grow to **£4.9bn** by 2030 but **unsustainable activity risks this.**

Many shipping and ferry lanes overlap with whale migration, feeding and nursing grounds - leading to ship strikes and noise and water pollution impacts

Executive summary

Marine ecosystems are an essential yet overlooked part of our planet, receiving less than 1% of all climate finance.

Climate change is increasingly well understood by society, governments, and businesses. This is only one of several interlinked crises. Biodiversity loss is often overlooked, as more focus is typically placed on land rather than the ocean. The ocean and its complex ecosystems host at least 250,000 species and capture 25% of all carbon dioxide emissions. Yet, unsustainable practices and under-investment are leading to a near-irreversible depletion of marine ecosystems, coastal and deep sea.

The depletion of marine ecosystems has profound effects on the environment, society and businesses. Yet business impacts on marine ecosystems remain relatively unrecognised and unmonitored which hinders conservation and restoration efforts. In addition to this, there is an urgent need to gather more data on the ocean and marine ecosystems, to better understand the impact and remedies of biodiversity loss.

The depletion of marine ecosystems has profound effects on the environment, society, and businesses.

This study, written in collaboration with Whale and Dolphin Conservation (WDC) aims to raise awareness of the value and importance of marine ecosystems. It does this by using cetaceans (whales, dolphins and porpoises) as a theme throughout. Cetaceans provide significant benefits across a diverse range of areas which are not limited to their, sometimes exploitative, 'use' value, through the way they live, feed, migrate, play, defecate, procreate, and even die.

This study outlines a holistic framework for valuing living species and ecosystems while providing new quantitative estimates where possible. It also demonstrates the 'services' that cetaceans freely provide to businesses, the environment, and society. For example:

- Cetaceans support phytoplankton growth, boosting ocean biomass and biodiversity throughout the ecosystem
- Cetaceans provide significant carbon capture benefits. The estimated carbon capture value of a single blue whale off the coast of Brazil is £2mⁱ
- Illustratively, the whale watching industry is estimated to be worth £3.1bn annually and provides educational benefits along with improved wellbeing for participants.

ⁱ although this is subject to significant uncertainty

A lack of investment in ocean data gathering means that there is not a full understanding of the broader impacts of and solutions to marine biodiversity loss. This has resulted in unfortunate hesitation among decision-makers in taking positive action to protect the marine environment. One of the key calls-to-action in this study is for businesses and policymakers to accelerate steps to increase the quantity of and access to ocean data. This will significantly benefit efforts to combat the biodiversity and climate crises.

Businesses face increased scrutiny on their impacts on biodiversity loss and ecosystem degradation. This creates a fast-moving business landscape that presents risks and opportunities.

Historically, impacts on the ocean, its ecosystems and cetaceans have not been priced into decisions within our economic system. This has resulted in ecological and societal harms that leaves ecosystems under significant threat.

Within this changing landscape, risks and opportunities emerge – as defined by the Taskforce on Nature-related Financial Disclosures (TNFD):

- Risks can be categorised as physical, transitional and systemic. These apply to all businesses and include negative impacts from environmental events, changing policy and legal frameworks, evolving consumer behaviour, and financial contagion
- Opportunities can impact business and sustainability performance. These include resource efficiency, developing product and service markets, access to capital, and reputational benefits.

There is an urgent and growing need for public and private sector organisations to make informed and strategic decisions that will protect marine ecosystems. Collaboration will be a key enabler of this. Organisations can gain by taking proactive action now, or risk being reactive.

Humans need nature more than it needs us. Recognising that nature is not reliant on humans for its survival provides a humble lens to better understand our reliance on nature, including the ocean. It highlights our collective sense of responsibility to nature at large.

This report casts a spotlight on four selected sectors - Food Retail, Shipping, Finance, and Tourism - outlining the impacts, risks, and opportunities for each.

Food

The food system is dependent on marine ecosystems, yet some activities place significant detrimental impacts on these ecosystems. The Food Retail sector is well-placed to tackle this.

Historically embedded practices of the food retail sector and their suppliers lead to impacts ranging from plastic pollution, to fishing bycatch and ghost gear, and pollution from agricultural run-off. These impacts are material – for example, bycatch comprises at least 40% of all fish landings and kills 300,000 cetaceans annually. These impacts undermine marine ecosystem services, putting food sector supply chains and assets at risk, contaminating seafood and agricultural products, and creating externalities beyond the food sector which creates reputational risk.

These impacts are material – for example, bycatch comprises at least 40% of all fish landings and kills 300,000 cetaceans annually.

Aside from the physical risks arising from the dependency of food retailers on marine ecosystems, the perceived negative impact of the Food Retail sector creates more significant and growing transition risks. This includes (but is not limited to) higher operating costs, changing consumer choices, legal and regulatory consequences, and access and cost of capital.

This fast-changing landscape creates opportunities. The most forward-looking food retailers have started to act. These range from short-term options to longer-term interventions, such as:

- Leverage changing consumer patterns – a Deloitte survey found that 40% of UK adults had chosen brands that have environmentally sustainable practices in 2022 – for instance, by supporting eco-friendly markets through ecolabelling and investing in ocean-friendly projects
- Continuing to work with supply chains to phase down plastic packaging
- Encouraging the deployment of technology to enhance traceability in the food system
- Developing organisation-wide nature strategies
- Engaging suppliers and in industry initiatives to help drive sector-wide change
- Engaging governments and regulators to put in place the enabling policy framework
- Exploring collaboration opportunities with conservation organisations that need support to accelerate towards positive change.



Shipping

The Shipping sector is subject to growing reputational risk arising from damage to marine ecosystems. There are concrete steps that can continue to be taken to mitigate this damage.

The Shipping sector is a vital part of the global supply chain with over 80% of the world's trade being transported by sea. However, shipping directly damages marine ecosystems, with which it shares the ocean. Some of the world's busiest shipping lanes overlap with marine biodiversity

Underwater noise pollution has doubled every decade for the last 50 years.

hotspots, creating significant impacts such as water pollution, noise pollution and ship strikes. Underwater noise pollution has doubled every decade for the last 50 years. Ship strikes have become a leading threat to whales.

The negative impact on marine ecosystems and externalities on other ocean-dependent sectors creates transition risks such as access and cost of capital, reputational damage, legal and regulatory consequences, and geopolitical risks causing the fragmentation of supply chains.

Some shipping operators have started to act on the clear opportunities to mitigate impacts, such as:

- Reviewing vessel routes and reducing speeds (which also reduces noise, fuel consumption, and carbon emissions)
- Developing organisation-wide nature strategies
- Increasing conservation knowledge by supporting research efforts
- Encouraging industry initiatives and sharing best practices
- Exploring collaboration opportunities with conservation organisations that need support to accelerate towards positive change.



Finance

Financial flows can be an enabler of harm to marine ecosystems. The Finance sector is in a unique position to make downstream positive change through the efficient allocation of capital and provision of insurance.

Finance flows to activities that harm marine ecosystems puts invested capital in ocean-dependent sectors at risk as well as accelerating negative externalities that impact the whole economy.

A historic neglect of nature means there has been little appetite to invest in the conservation of marine ecosystems. As Deloitte's *Drop in the Ocean* report highlighted, the best available estimate puts the amount of climate finance received by nature at less than 3% of the total.

For the ocean, this figure is less than 1%. However, the landscape is shifting, with increased pressure from governments, regulators, markets, and consumers to re-align finance with conservation goals and start to understand, assess, and disclose their financed impacts on nature across their

A historic neglect of nature means there has been little appetite to invest in the conservation of marine ecosystems.

portfolios (in the same way that finance firms need to assess and disclose their financed greenhouse gas emissions).

This creates clear risks, such as lower returns, risk of stranded assets, reputational risk, and legal, regulatory and compliance consequences.

Opportunities arise too, some of which can create value now, and some which will have longer-term payoffs. Forward-looking organisations have already started to act. These include:

- Identifying and assessing organisational nature-related (and ocean-related) risks
- Eliminating financed impacts on nature (and the ocean) from organisational portfolios
- Investing in "blue carbon" projects
- Creating new nature-positive markets and mobilising capital to invest in them
- Using networks and influence to accelerate transition in other sectors
- Exploring collaboration opportunities with conservation organisations that need support to accelerate towards positive change.



Tourism

Marine ecosystems support the Tourism sector. This contributes significant economic and societal benefits and provides significant room for growth. Yet, unsustainable and uncoordinated tourism risks this.

Coastal and marine tourism constitutes approximately 50% of all global tourism. It is a major component of many thriving coastal communities. It provides significant contributions indicatively, the whale watching industry contributes c. £3bn annually to coastal and wider economies, alongside additional wellbeing and educational benefits.

Indicatively, the whale watching industry contributes c. £3bn annually to coastal and wider economies.

However, the rapid growth of unsustainable marine tourism is endangering the marine ecosystems on which the industry relies, resulting from marine litter, noise and other pollution, boat collisions and carbon emissions.

Alongside the physical risks to the tourism sector of the degradation of ocean ecosystems, there are also transition risks with potentially significant business and regional economy implications such as higher operating costs, changing consumer patterns, reputational risk, and reduced access to capital.

That said, progressive tourism operators have started to act on the significant opportunities that can be leveraged. For example:

- Developing and adhering to sustainable tourism codes of conduct
- Driving industry wide action to reduce pollution and carbon emissions
- Integrating volunteering experiences with tourism
- Fostering alliances between tourism operators, INGOs, researchers, citizen science to assess marine ecosystem health
- Championing marine ecosystems to other sectors
- Exploring collaboration opportunities with conservation organisations that need support to accelerate towards positive change.

The business case for preserving marine ecosystems that underpin tourism offerings is clear, but in a fragmented industry especially smaller players cannot do so alone. There is a role for both large and small organisations, and governments to coordinate a more impactful response.



Deloitte has developed its *WorldClimate* strategy in response to environmental crises.

The strategy includes making responsible sustainable choices, committing to science-based goals, collaborating through partnerships, and educating and inspiring our people to help guide our sustainability journey. This is outlined on the WorldClimate webpage and in Deloitte's Impact report.

Similar calls-to-action are made to organisations to restore and conserve marine ecosystems:

- **Understand** the value of the ocean and your relationship with it
- **Commit** to ambitious goals and science-based targets on climate and biodiversity
- **Develop** a plan for a net zero, biodiversity positive transition that integrates action to protect and invest in nature - including ocean recovery
- **Embed** climate and biodiversity goals into your business, commercial and risk management frameworks and processes
- **Report** publicly on your biodiversity-related risks and opportunities and how you are responding
- **Support** data collection and leverage associated benefits
- **Collaborate** to drive wider change in your sector and the Blue Economy
- **Seek** external partnerships to help restore the ocean
- **Advocate** for ambitious government policies that will help businesses scale and speed up efforts to boost ocean recovery.

Further detail on the opportunities and calls-to-action can be found later in this report.



Introduction

This study has been produced in collaboration with Whale and Dolphin Conservation (WDC). It builds on the *A Drop in the Ocean* report and explores the importance of marine ecosystems.

It provides insight into the risks and opportunities for selected economic sectors and the value at stake for society and the environment.

This report is limited by the resources, research, and data available. It is not exhaustive and can only scratch the surface of a complex topic. It is intended to form a basis for discussion around the further data needed and positive actions that can be taken now.



The importance of biodiversity and marine ecosystems

Climate change and the pathway towards mitigating it is increasingly well understood by society, governments and businesses. This is demonstrated by the focus on net zero.

While reversing global warming is of paramount importance, the environmental challenge is much broader. It encompasses biodiversity loss and ecosystem degradation, alongside other planetary boundaries, which are often overlooked. These challenges are complex and closely interlinked. For example, the impact of ocean acidification on biodiversity is a result of carbon emissions, and further demonstrates the climate-nature nexus. While this report will reference climate change, its focus will be on biodiversity impacts and the degradation of ecosystems.

“Our world must not only become net zero, but also nature positive, for the benefit of both people and the planet.”

(G7 leaders)

To many, these concepts evoke images of rainforests, polar bears and bees. The ocean and its ecosystems are often overlooked despite them being critical for life on Earth as a habitat and through its climate regulatory function. The ocean constitutes 99% of habitable space on the planet,¹ provides a home for at least 250,000 species,² captures 25% of all carbon dioxide emissions, absorbs 90% of excess heat,³ and creates 50% of the oxygen produced by plants.⁴

A degrading ocean is very literally a threat to our survival.

Human activity is significantly deteriorating these fragile marine ecosystems and impacting their ability to perform the ecosystems services we all depend on. Parts of the fishing sector are devastating food sources and wider marine ecosystems through exploitation of resources and unintended consequences such as ghost nets and bycatch.

According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), one third of fish populations are classified as over-exploited.⁵ The food sector – alongside other consumer sectors – is polluting our ocean

with agricultural runoff and plastic waste. Shipping is negatively impacting marine ecosystems through pollution, noise, emissions, and ship strikes.

The consequences of human activities go beyond our ocean and its ecosystems. They also impact human economies, societies, and significantly affect our food system. Chemical pollution from agricultural and industrial waste are accumulating in marine creatures that form an important part

of our food supply, while concentrating in the top layer of the ocean. This evaporates into our atmosphere and contaminates our food supply and water supplies through rainwater. Plastics are entering our food supply through the marine animals we consume.

These devastating effects are the result of a failure to recognise the critical importance of marine ecosystems and build responsibility for minimising and addressing externalities into our economic systems. It is important to develop an understanding and appreciation for the complexity, interdependencies and value that exist within the ocean environment.

In the global context, conserving and sustainably using the ocean and its marine ecosystems has been identified as a Sustainable Development Goal (SDG) by the UN (Goal 14).

However, as explored in *A Drop in the Ocean*, it is the least-well funded SDG with an annual funding gap of around \$150bn.⁶



Case study: Ørsted

Ørsted are recognised as global leaders on climate action.⁷ Once one of the most coal-intensive energy companies in Europe, they transitioned in the space of a decade to be ranked the world's most sustainably electric utility in the Corporate Knights Global 100 index for 2023. They were also the first energy company in the world to have their science-based net-zero emissions target validated by the Science Based Targets initiative (SBTi).

Ørsted also recognise the need to address the climate and biodiversity crises simultaneously, given their deep interconnections. Therefore, they have set the ambition that all new renewable energy projects they commission from 2030 should deliver a net-positive biodiversity impact. To achieve this, Ørsted are partnering with a wide range of experts to develop biodiversity restoration programmes with a particular focus on ocean health. Cetaceans are also considered, for example through the ECO-PAM project (in partnership with Rutgers University, Woods Hole Oceanographic Institution, and the University of Rhode Island) which aims better understand the North Atlantic right whale.⁸

What is the Blue Economy?

The ocean and its marine ecosystems underpin our economies. From the seafaring coastal traders of antiquity to the present-day economies of global powerhouses, the huge biodiversity and abundance of the seas have allowed civilisations to expand and thrive. A World Wide Fund for Nature (WWF) report conservatively valued the then-known “asset base” of the ocean at \$24 trillion each year, with \$2.5 trillion in goods and services from coastal and oceanic environments – equivalent to the 7th largest economy by GDP in 2015, just behind the United Kingdom.⁹

The tides are now turning.

These assets are largely made up of commercially established and well-understood resources like fish populations and aquaculture. Beyond food, the ocean provides us with opportunities for tourism, navigable trade and transportation routes as well as substantial natural energy resources.¹⁰ Near the coast, mangroves, saltmarshes and coral reefs provide free and natural protection against flooding, and cycle minerals that support healthy coastal

ecosystems. The deep ocean provides significant resources too, including whales and the ecosystem services they provide.

Alarmingly, in a world of 2°C warming – which current global climate commitments easily overshoot – it is estimated that 99% of all coral reefs will be lost.¹¹ For perspective, a 2017 Deloitte report assesses the yearly economic contribution of the Great Barrier Reef alone at \$6.4bn – and this only includes the value it adds to the economy and the jobs supported, and not the wider social and iconic value that it provides.¹²

In the past, it was only clear that businesses dependent on marine ecosystems would be impacted by its deterioration. The tides are now turning. Sectors that directly or indirectly impact marine ecosystems are now subject to fast-changing operating environments. Increased pressure from governments, regulators, markets, and consumers to align with conservation goals are driving forward-looking businesses to take positive actions to limit their environmental impacts.

Perhaps there is a future in which the ecosystem services that nature provides are measured and captured by market-based instruments, which consumers of those services then (compulsorily) purchase. Carbon offsets are likely to be the first example. But markets aren't there yet. In the meantime, the more organisations that act in recognition of their impact, obligation and interest, the quicker positive impacts will be felt.

The ocean and its marine ecosystems can only continue to underpin the global economy if it were to be sustainably managed – this sustainable ocean economy is coined as the ‘Blue Economy’.

The speed of mitigation action is critical to marine ecosystems – this was outlined recently in the IPCC Synthesis Report.¹³ With trends fast-moving in a positive direction, for example with the recent development of the market-led TNFD framework, the pressure on businesses to act is rising.¹⁴ The time to begin taking actions is now.

This report explores the actions that can be taken by businesses and policy makers. This includes specific examples for those sitting in the following selected sectors:

- Food retail
- Shipping
- Finance
- Tourism.



Assessing the true value of cetaceans

Considering the complexity of the ocean and its marine ecosystems, cetaceans – the infraorder covering whale, dolphin and porpoise species – are used as a theme throughout.

Cetaceans are cast as ‘ocean ambassadors’ in this report because of their charismatic nature, and the significant ecosystem services they provide.

These include playing a critical role in supporting the ocean’s biomass, biodiversity, and capture of human-created CO2 emissions. These iconic species are our unsung allies in the climate, biodiversity, and ecosystem emergencies.



Whales act as ecosystem engineers

boosts local fish numbers as fewer predators are present to reduce krill populations and directly feed on the fish. However, it is generally accepted that this is incorrect. Evidence supports the positive role for cetaceans on fish populations – removing cetaceans from the marine ecosystems does not lead to an increase in fish populations and in certain scenarios can lead to a decrease in fish populations.¹⁶ It is estimated that the removal of large species (such as cetaceans) can decrease total community biomass by 30%.¹⁷ It is also crucial to recognise the global role whales and other cetaceans play. Migratory whales travel thousands of kilometres, releasing nutrient rich organic matter across multiple regions of the ocean, that help sustain a wide variety of marine biodiversity and ecosystems.

Whales act as ecosystem engineers. They transfer nutrients within the water column and across latitudes, as well as storing and sequestering carbon. Their carcasses can also provide vital habitats for deep sea organisms, a process known as whale falls. This process takes the accumulated carbon with them to the ocean floor where it can be stored for potentially thousands of years.

Through this process, whales help fertilise the ocean and stimulate fish populations by enhancing ecosystem productivity. While estimates are uncertain, the average blue whale off the coast of Brazil contributes around £300,000 to commercial fisheries in present value terms.¹⁵ There has been a misconception that reducing cetacean populations

Despite this, cetaceans suffer significant harms. This has been both accidental and deliberate - from captivity, whaling and hunting, to the damage that human activity has directly caused to cetaceans and their environment, for example via fishing bycatch. An estimated 3m whales were hunted in the 20th century.¹⁸ According to the International Union for Conservation of Nature (IUCN), around 25% of cetacean species are threatened,¹⁹ with the population of some species falling into the tens.

The vaquita, a small porpoise found only in the Gulf of California, is critically endangered, with the last IUCN estimate putting the number of individuals at 18 and decreasing.²⁰ The North Atlantic right whale, which migrates between the Gulf of Mexico and the North Atlantic, is also critically endangered, with only a few hundred individuals left.²¹ Solutions to save these species from extinction are available but require more attention and resources.

On the positive side, the public's interest in cetaceans and conservation is rising. This, when combined with conservation activity led by charities such as WDC, has supported a general increase in the cetacean population in the 21st century. However, significant pressures continue with many cetacean species populations remaining depleted due to 20th century whaling and continued habitat destruction alongside unintentional deaths from, for example, fishing bycatch and ship strikes.

This report explores the benefits that cetaceans provide in their current state, as well as the potential benefits they could provide if populations return to their pre-whaling, and pre-industrial levels.

Whale pump

How whales sustain life on earth and fight climate change

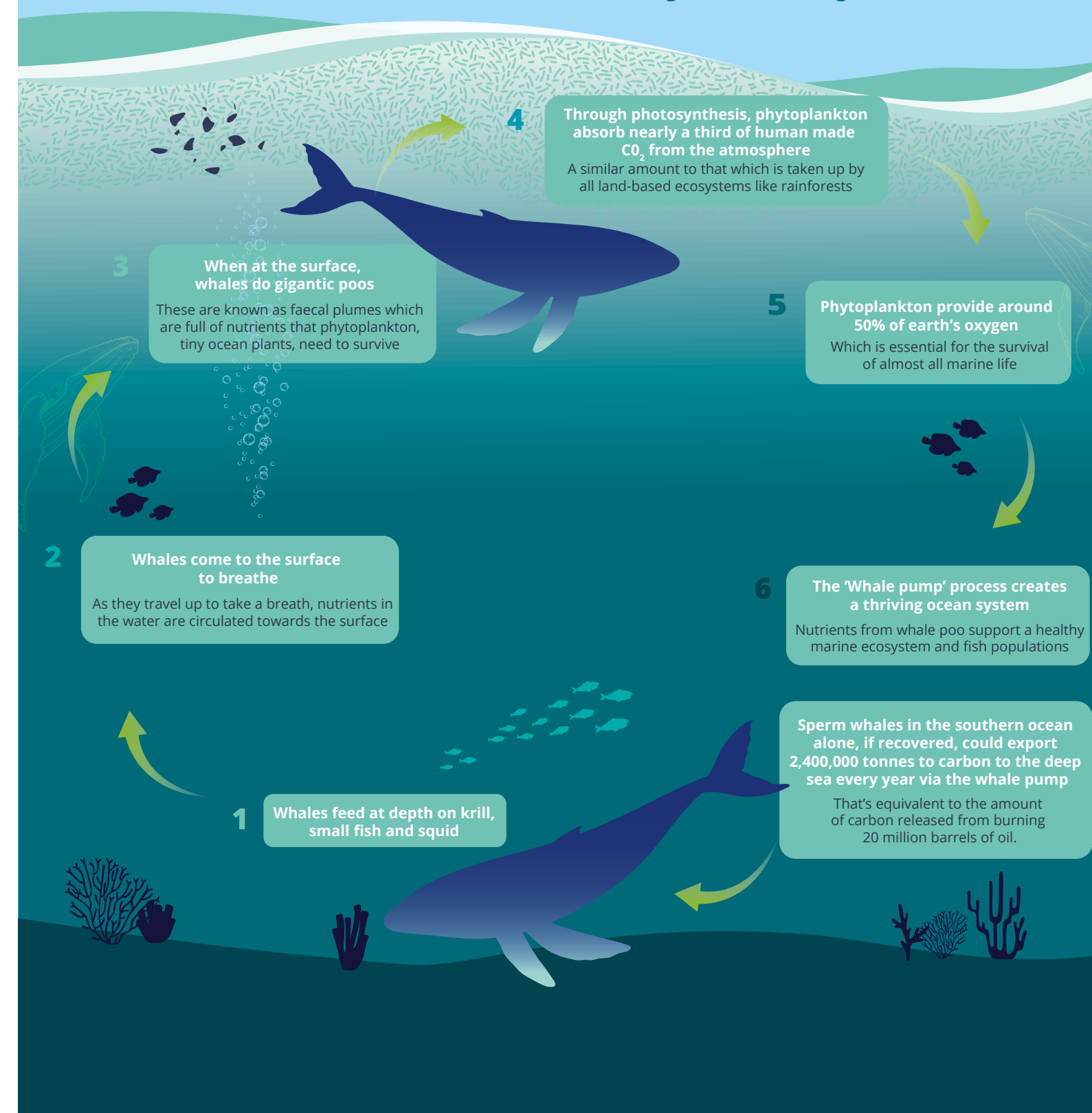


Figure 1: The 'Whale Pump'

Applying a true value framework

Cetaceans play an important role in marine ecosystems, but their impact stretches far beyond ecosystems and the sectors outlined elsewhere in this report.

Their impact pervades society, the economy, and the environment – creating value and positive outcomes across these three themes.

There is rich and varied literature covering the socio-economic and environmental contribution of many species, but particularly so for cetaceans.

This short chapter builds on previous research by taking a holistic approach to generate a “Value Framework” which draws the research together. The study also provides some new quantitative estimates for whale watching, including a current and forecast economic contribution, wellbeing, and inequality benefits. This study is limited by resources, research, and data available and is therefore not exhaustive.

The literature mainly focuses on economic valuation via observable effects in areas such as tourism and carbon sequestration. “Value” in this context is usually measured using monetisation techniques, but other types of value are intrinsic in nature and

cannot be measured in this way. This is one reason why it is hard to obtain an overall estimate of the full value generated by cetaceans. Other reasons being comparability of research, double-counting and, above all, a lack of data: something vitally important and detailed in our calls to action.

The Value Framework: a holistic view

The Value Framework identifies the different types of value associated with cetaceans within a logical categorisation, providing quantitative estimates where possible to highlight the scale of contribution. It aids understanding of the diverse and stackable benefits that cetaceans bring to the economy, society, and the environment.

The value framework has been developed to include ecological and socio-economic value, the latter on a non-extractive basis only.ⁱⁱ This covers the value that

ⁱⁱ Whaling and other non-sustainable activities are excluded from the value framework.

accrues to nature, in addition to humans. In other words, it covers the intrinsic and biophysical value that cetaceans provide, in addition to the “utilitarian” benefits understood by humans.

The framework acknowledges that there are interdependencies between the two. For example, increasing economic value from cetaceans (such as increasing whale watching) can also result in additional conservation efforts directed to cetaceans, resulting in additional ecological value, and vice versa.

The value framework consists of two main parts:

- 1. Total ecological value** referring to the benefits of cetaceans for cetacean individuals, marine ecosystems, and nature as whole
- 2. Total economic value** referring to the benefits that accrue to humans through cetaceans. This includes:
 - **Use values** – services used directly by humans such as tourism, and services which benefit humans indirectly such as climate change mitigation
 - **Non-use values** – value to humans derived from the knowledge of the existence of a species, even if they never have or will use them
 - **Option values** – value to humans derived from retaining the option of benefiting from species in the future.

The value framework for cetaceans is presented in Figure 3 with descriptions of each component of the framework described and scored afterwards.



Figure 3: Cetacean Value Framework

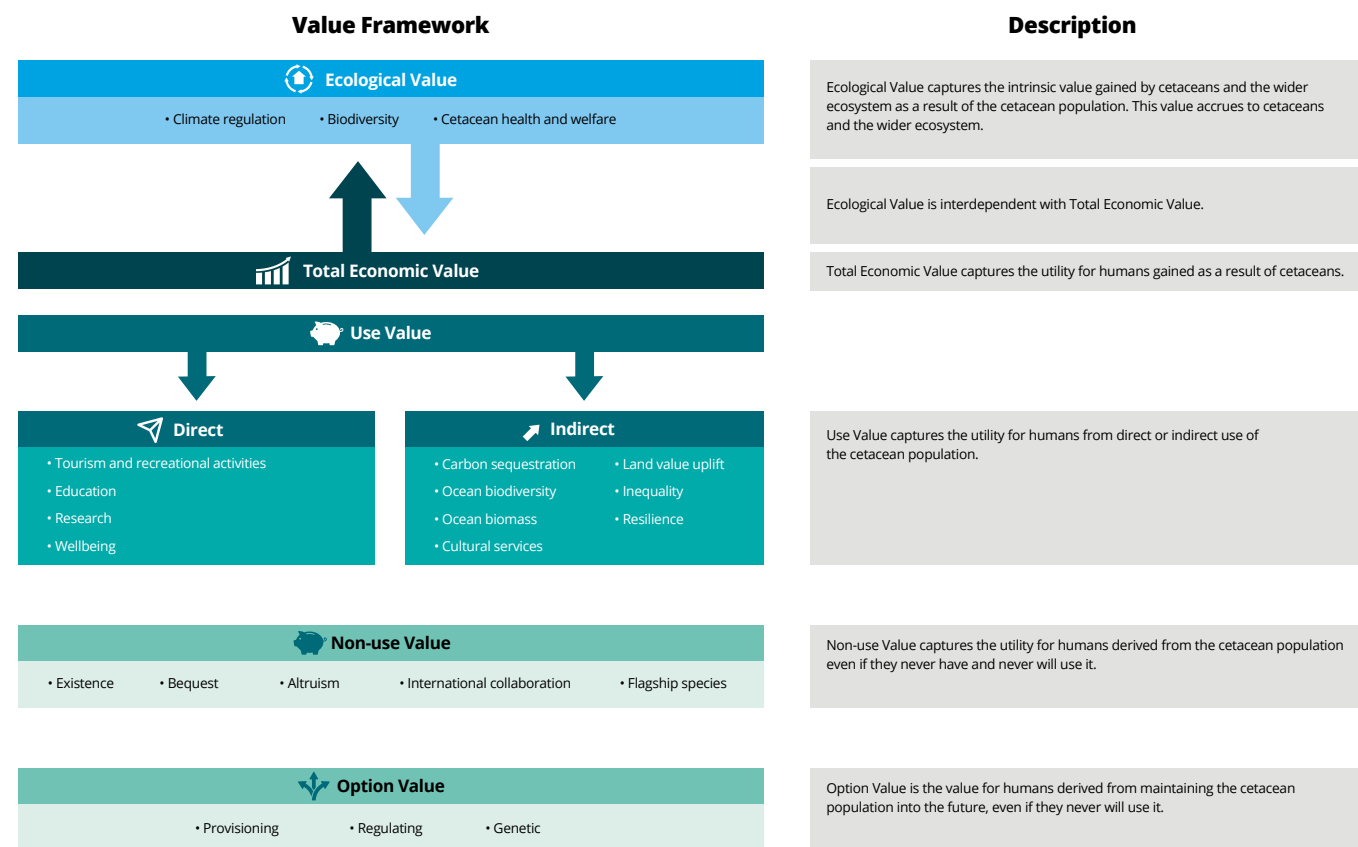


Table 1 (found overleaf) provides descriptions and evidence, as well as an indicative assessment of the relative significance of each factor in the context of the value framework.

This includes the current value added by cetacean populations at present as well as providing an indication of the potential value in the case that their populations rise to the pre-whaling steady state. This qualitative assessment should be treated as illustrative only. It was informed by a mixture of qualitative and quantitative evidence, and tested with subject matter experts to reach a consensus – the key can be found below:

5	Deemed high value in comparison to all other value drivers.
4	Deemed average to high value in comparison to all other value drivers.
3	Deemed average value in comparison to all other value drivers.
2	Deemed low to average value in comparison to all other value drivers.
1	Deemed low value in comparison to all other value drivers.
+	Where a "+" is added to the score, this means the value is assumed to increase if the cetacean population rises.



Table 1: Summary of Cetacean Value Framework

Value Type	Value Driver	What is the value created?	What is the evidence underpinning this?	Relative value (illustrative)
Ecological Value	Biodiversity	Value gained by cetaceans and wider ecosystems as a result of cetaceans' impact on marine biodiversity.	Cetaceans support ocean biodiversity. For example, the lifecycle of whales leads to phytoplankton growth, creation of new habitats, and increase in fish populations - all of which contribute towards marine biodiversity. Small cetaceans such as dolphins, porpoises and small toothed whales have significant ecological impacts on their communities and ecosystems particularly in tropical and warm temperate ecosystems. ²²	4+
	Climate regulation	Value gained by cetaceans and wider ecosystems as a result of cetaceans' impact on the climate.	Cetaceans capture carbon which mitigates climate change impacts – this helps cetaceans and ecosystems by reducing ocean warming and acidification which lead to deteriorating marine ecosystems. According to an IMF report, letting whales return to pre-whaling numbers – to almost three times their estimated current population – could capture 1.7bn tons of carbon dioxide annually. ²³ This significant increase could therefore provide significant climate regulation benefits. Great whales are particularly efficient in transferring carbon from surface to deep waters, thereby sequestering it. ²⁴	4+
	Cetacean health and welfare	Value gained by cetaceans from greater health and wellbeing	Cetaceans are known to be sentient and sapient individuals. Many species live in complex social groups and exhibit complex behaviours such as cooperation and tool use. Therefore, supporting the cetacean population to thrive will lead to greater cetacean welfare and reduced suffering. While the impact of cetaceans on the welfare of other species is mixed, the removal of cetaceans or other species as a result of human activity can negatively influence marine ecosystems, such as abrupt decline in kelp forests and habitats in the North Pacific. ²⁵	2+
Total Economic Value	Tourism and recreational activities	Economic contribution from cetacean-related tourism and recreational activities.	Whales have a significant impact on the tourism and recreation industry where whale watching is a popular activity. People travel to destinations specifically to observe whales in their natural habitats, spending significant amounts locally. Whale watching is illustratively estimated to contribute £3.1bn to the global economy currently, with potential to contribute £4.9bn by 2030. ⁱⁱⁱ However, detrimental effects from crowding, pollution, carbon emissions and other unsustainable tourism activities put this growth at risk and should be carefully managed. Other cetacean-related recreational activities include kayaking and yacht charters, and cultural visits are also indirectly supported by cetaceans.	4+
	Education	Value of education that involves cetaceans, for example in conservation or biology.	Cetaceans play an important role in building knowledge, awareness, and conservation benefits. Education also has wider conservation benefits in effecting behavioural change, such as adoption of pro-environmental actions and donations to conservation activities. Studies suggest that the unique characteristics of cetaceans such as their size, intelligence, and charisma capture people's attention and can be effective in educating people about the behaviour and natural habitats of marine species as well as the importance of marine conservation. ²⁶	2+
	Research	Value of research that involves cetaceans.	Cetaceans are studied to understand ecological, conservation, medical, and climate related topics. There are many examples where researching for cetacean wellbeing has spillovers that generate value, such as: <ul style="list-style-type: none"> Cetaceans are informative for monitoring ocean health, with the potential for using strandings data to identify changing oceanic trends to inform climate policy.²⁷ Scientific research has revealed that whale fall bacteria are a novel source of cold-adapted enzymes with potential utility in cold-water detergents. 	2+
	Wellbeing	Value derived from wellbeing improvements as a result of cetacean-related activities.	Cetaceans positively influence human wellbeing through interaction. For example, the knowledge that cetaceans exist, and that some species are thriving can reduce ecoanxiety. Another example is the benefits of whale watching which involves spending time in marine environments. It is estimated that the total wellbeing benefits from whale watching in the UK is around £200m per annum. ^{iv} These effects are above and beyond the market value of whale watching that can be estimated from market data.	2+

iii Deloitte estimate of the whale watching economic contribution based on a study by Cisneros-Montemayor *et al.*,ⁱ inflated by estimates of the growth of the global tourism sector from UNWTO,ⁱⁱ IBIS World,ⁱⁱⁱ and WTTC.^{iv} These estimates are illustrative and subject to significant uncertainty.

iv Deloitte estimate using the additional yearly income equivalent of the wellbeing increase from taking an additional boat trip based on a survey by the Canal & River Trust,^v adjusted for the estimated expected additional satisfaction from seeing whales using a study by Tkaczynski,^{vi} multiplied by an estimate of total number of whale watching trips taken adjusted from a study by O'Conner *et al.*^{vii} These estimates are illustrative and subject to significant uncertainty.

Value Type	Value Driver	What is the value created?	What is the evidence underpinning this?	Relative value (illustrative)
	Carbon Sequestration	Value derived from carbon storage as a result of cetaceans.	Cetaceans play a vital role in influencing the carbon dynamics in the environment through their carbon sequestration services. Whales directly capture carbon through biomass as well as 'whale falls.' They also indirectly influence carbon capture by stimulating phytoplankton growth through their excreta. Phytoplankton growth helps mitigate climate change by capturing carbon and producing large amounts of oxygen. For a blue whale off the coast of Brazil it is estimated that the present value of carbon capture per whale is £28k (2022 values), whilst the value of carbon captured from increased phytoplankton was found to be approximately £2.0m (per blue whale off the coast of Brazil). ^v This could increase should the market price for carbon rise, however, there is significant uncertainty over estimated carbon capture via increased phytoplankton and these figures are not representative of the average cetacean. Nonetheless, according to an IMF report, if cetaceans reach their pre-whaling populations (an estimated 3x their current population), their carbon sequestration is estimated to be 1.7bn tons of CO2 annually. ²⁸	4+
	Ocean biodiversity	Value derived from additional marine biodiversity as a result of cetaceans.	Blue whales, along with other great whales, contribute to nutrient cycling through their movement, particularly iron and nitrogen, and fertilize phytoplankton growth when they defecate, which then feeds fish and other species. Whale falls contribute to ocean biodiversity by supporting a widespread fauna. To put this in context, on the seafloor of the North Pacific, whale falls support the survival of at least 12,490 organisms of 43 species; ²⁹ local species diversity on large whale skeletons during whale fall may be higher than any other deep-sea hard substratum community. ³⁰	4+
	Ocean biomass	Value derived from additional marine biomass (such as fish) as a result of cetaceans.	Cetaceans contribute to living marine biomass, for example through facilitating phytoplankton growth. Phytoplankton is one of the single largest removers of carbon in marine ecosystems. Phytoplankton also supports growth of other species in marine ecosystems, e.g., fish. While some cetacean species may have negative localised impacts on some species, the removal of large species (such as cetaceans) can decrease total community biomass by 30%. ³¹ Furthermore, while estimates are uncertain, the average blue whale off the coast of Brazil contributes around £300,000 to commercial fisheries in present value terms. ^{vi}	3+
	Cultural services	Value derived from additional culture in human society as a result of cetaceans.	Whales specifically provide a broad array of cultural services, ranging from physical and experiential interactions with natural environments to spiritual and symbolic interactions. Whales have a significant role in numerous indigenous cultures. For example, in Hawaiian culture whales are generally viewed as divine beings and spiritual protectors. ³² They also contribute to entertainment, for example over 150 items of popular music have sampled whale music owing to its capacity of evoking a wide range of emotional responses from humans. ³³ Great whales have also been the focal point of globally acclaimed movies such as Free Willy and Whale Rider, alongside books such as Moby Dick.	3
	Land value uplift	Additional local value of land, property and territory as a result of cetaceans.	Whale watching and tourism more generally can support an increase in local property prices where these activities take place. This results from additional demand for housing and land. The disbenefits of climate change are also anticipated to have a negative impact on land value – the carbon sequestration from cetaceans mitigates the impact of climate change and a rising sea level, thereby mitigating costs.	1+
	Inequality	Value derived from the distribution of economic activity as a result of cetaceans.	According to one study, in 2009 countries across the globe were hosting 13m whale watchers a year, generating a total of \$2.1bn. 20% of this accrued to developing countries. The study estimates that countries that currently have no whale watching could support an industry worth \$830m with 11,000 jobs, and half of these benefits could accrue to developing countries (as defined by the UN ³⁴). ³⁵ This industry and any additional income from it would be worth more for those in lower income countries. Accounting for this, the benefits in developing countries are illustratively estimated to be worth £6.9bn in 2030, although this is dependent on the level of growth and additionality. ^{vii} Existing environmental pressures such as crowding may need to be alleviated to achieve this, which is supported by a larger cetacean population.	2+

^v Estimates from a study by Chami et al.^{vi} for the present value of carbon captured by the total population of blue whales off the coast of Brazil, divided by the population and adjusted into current prices and GBP. These estimates are subject to significant uncertainty.

^{vi} Estimates from a study by Chami et al.^{vi} for the present value of fisheries enhancement by the total population of blue whales off the coast of Brazil, divided by the population and adjusted into current prices and GBP. These estimates are subject to significant uncertainty.

^{vii} Deloitte estimates using the difference between incomes (PPP adjusted) in developed and developing maritime countries with an estimated marginal utility of income of 1.3 to calculate a welfare weight as per the UK Government's Green Book.^v This is applied to the economic contribution of whale watching in developing countries as per Deloitte estimates based on a study by Cisneros-Montemayor et al.^{vi} It is assumed that this benefit is relative to all whale watching activity occurring in developed countries. These estimates are illustrative and subject to significant uncertainty. Detrimental effects from crowding, pollution, carbon emissions and other unsustainable tourism activities put this growth at risk and should be carefully managed.

Value Type	Value Driver	What is the value created?	What is the evidence underpinning this?	Relative value (illustrative)
	Resilience	Value derived from additional ecosystem resilience as a result of cetaceans.	Cetaceans support marine biodiversity and ocean biomass. This supports ecosystem resilience through various factors such as their position in the food chain, the carbon captured directly from whales and indirectly as a result of their ecosystem services and genetic diversity. Evidence suggests that cetaceans also play a significant role in struggling ecosystems. For example, one study finds that spinner dolphins play a significant role in supporting struggling coral reef ecosystems. ³⁶	2+
	Existence	Value derived for humans from the knowledge that cetaceans exist.	People value the existence of cetaceans – this is supported by studies across a number of cetacean species – it is estimated that the existence value of beluga whale populations in the Arctic to be £25bn per year. ^{viii} Another study also estimates existence value through a contingent valuation study for grey whales. ³⁷ The relative rarity, intelligence, distinctness and aesthetically pleasing qualities of whales means that their preservation is valued. ³⁸ More broadly, people also value the existence of increased biodiversity, which cetaceans support.	3
	Bequest	Value derived for humans from the knowledge that cetaceans will exist in the future.	Current generations place value on the existence of cetaceans – this is supported by studies across several cetacean species which are discussed under the ‘existence’ value. This occurs not just for present day existence (i.e., ‘existence’ value) but also future existence, known as the ‘bequest’ value. ³⁹	2
	Altruism	Value derived for humans from donations (at personal cost) that confer benefits for cetaceans.	People obtain satisfaction from altruistic acts towards animals – this can be demonstrated by donations to charities, and as understanding of animal welfare and environmental pressures increases, average donations to animal welfare charities have increased substantially over the past five years. ⁴⁰ In the context of cetaceans, people donate to charities such as WDC. WDC has approximately 31,000 financial donors across regions such as UK and North America.	2
	International collaboration	Value from collaboration opportunities between communities as a result of cetaceans.	International collaboration is critical for global economic and environmental policy, and cetaceans, owing to their highly migratory nature, provide an opportunity for regional as well as international collaboration amongst scientists, NGOs and governments, which may spill over into other areas of collaboration. Cetacean protection can provide opportunities for regional collaboration, such as through the development of regional networks or transboundary sanctuary agreements for migratory species as well as Marine Protected Areas (MPAs). ⁴¹ The recent ‘High Seas Treaty’ agreed at the UN (see Shifting Sands case study) is an example of this.	2
	Flagship species	Value from increased engagement with ecosystems because of the charismatic qualities of cetaceans.	Cetaceans are considered ‘flagship’ species. This is because they are charismatic representatives of the complex ecosystems they inhabit. Another feature they share with flagship species is their ‘size’ due to which they are labelled as ‘megafauna’. Conservation of flagship species can improve conservation of other species as they are able to raise awareness and increase engagement with the flagship species’ ecosystem (marine ecosystems in this context). Using flagship species in charity appeals increased donation amounts relative to appeals featuring non-flagship species, demonstrating the increased engagement as a result of flagship species. ⁴²	3+
	Provisioning	Value derived from maintaining the option of benefiting from the aforementioned use activities in the future.	Maintaining the population of cetaceans has an impact on the future value of aforementioned use and non-use factors – for example, the existence of cetaceans maintains the option for cetacean-related tourism and recreational activities occurring in the future. Cetacean repopulation could also increase the provisioning option value by increasing the scale of future use and non-use factors (e.g., greater opportunity for carbon sequestration in future with a larger cetacean population).	2+
	Regulating	Value derived from maintaining the option of benefiting from cetaceans’ regulating benefits on marine ecosystems.	Maintaining the population of cetaceans provides value in terms of the future option to use their regulating effects on marine ecosystems. One prominent example of this is that cetaceans take carbon dioxide out of the atmosphere, helping to regulate the climate. ⁴³ Increasing the whale population increases the option value for future regulating services by cetaceans on marine ecosystems.	2+
	Genetic	Value derived from maintaining genetic diversity – for example, for the option to use in future research.	Genetic diversity underpins ecosystem resilience – this is directly and indirectly supported by cetaceans, for example in the Mediterranean. ⁴⁴ Cetacean genomes can be used to support research and conservation, and cetaceans body shape and movement have been studied to increase the efficiency of underwater vehicles. ⁴⁵ and an increase in the cetacean population would make this more effective through increased sample size or reduced data collection costs.	1+

viii Estimates from a study by O’Garraⁱⁱⁱ for the existence value of Beluga whale populations in the arctic adjusted into current prices and GBP.

Summary of value framework findings

Overall, the value framework demonstrates the diverse and significant impacts that cetaceans bring to the economy, society, and the environment. These impacts are highly interconnected through the links between marine ecosystems, economies, and our climate. In addition, it highlights the potential sources of benefit should cetaceans return to their pre-whaling steady-state population – the steps to support this are explored later in this study. Supporting this are the following quantitative findings:

- Whale watching is illustratively estimated to have contributed £3.1bn to the global economy in 2022. This is forecast to grow to £4.9bn in 2030 – this growth opportunity is subject to significant uncertainty and may only be realised with sustainable tourism activities to reduce the climate and wider environmental impacts of this, which could in part be mitigated via growth in the cetacean population⁴⁶

detrimental effects from crowding, pollution, carbon emissions and other unsustainable tourism activities put this growth at risk and should be carefully managed⁴⁷

- Whale watching also has knock-on benefits for human wellbeing, which could be worth around £200m annually in the UK alone, estimated using the value of the boat trip and the additional wellbeing from a successful whale sighting⁴⁸
- Cetaceans have an important role in carbon sequestration. For example, the estimated value of a single blue whale off the coast of Brazil is around £2m. This covers both the direct carbon stored within the whale (£28k) and the indirect carbon capture as a result of the whale's impact on ocean biomass, estimated at £2m with significant uncertainty.⁴⁹ Letting whales return to pre-whaling numbers could capture 1.7bn tons of carbon dioxide annually.⁵⁰

These impacts are highly interconnected through the links between marine ecosystems, economies, and our climate

- The growth opportunity is disproportionately large in developing nations which may provide additional benefits through reduced inequality. The relative value of this opportunity is greater for those on lower incomes. Accounting for this (please see footnotes to Table 1 for methodologies), it is illustratively estimated to be worth £6.9bn to developing nations in 2030, dependent on the level of growth and additionality. This growth is also subject to

The value framework exposes a general lack of data and quantitative research. This was revealed in carbon sequestration and biodiversity, two key areas of value (in comparison to other factors and as shown in Table 1). For carbon sequestration, the high indirect value

is dependent on cetaceans' impact on ocean biomass. The scientific literature supporting this, while suggesting that there are significant positive impacts, is still at a developmental stage. This means that the £2m carbon value of a blue whale is subject to significant uncertainty in both directions.

This is an issue common to marine ecosystems in general.^{51,52} Compared to data on land, marine data collection is more costly and typically localised. This limits data at the global level, particularly for deep sea areas compared to coastal areas. There are a lack of precise population estimates for key species such as cetaceans. Where data does exist, it is often siloed, tightly controlled, or of low quality.⁵³ Alongside this, interactions within ecosystems are not well understood. Data limitations create challenges to estimating impacts, performing analyses, and galvanising a willingness amongst decisionmakers to invest in delivering solutions. Collaboration across the public sector, industry and NGOs is fundamental for enabling effective investment in sustainable management and restoration of marine ecosystems.

Addressing these data gaps is fundamental for enabling investment in sustainable management and effective restoration of the ocean, its ecosystems, and cetaceans.



Are you an ocean ambassador?

This chapter explores the risks and opportunities for businesses around marine ecosystems, illustrated with cetacean examples.

It focuses on four sectors: food retail, shipping, finance, and tourism.^{ix}

The loss of biodiversity from unsustainable human activity has brought the resilience of our planet's marine ecosystems to a critical point. As our economies depend significantly on the services marine ecosystems provide, this carries significant risks for societies, businesses, and providers of financial capital.

^{ix} This section explores only some of the key issues in each sector and is therefore not exhaustive.



The example provided in the *A Drop in the Ocean* report regarding the collapse of the Northern Cod population in 1992 demonstrates this – it led to the requirement of a \$2.4bn economic support package for businesses and the local community.⁵⁴

The world is increasingly conscious of biodiversity loss. Governments are recognising the importance of halting and reversing the planet's sixth mass extinction, driven in large part by human activity. Over 190 states committed to a set of ambitious goals and targets under the Global Biodiversity Framework (GBF) in December 2022.

Central banks now recognise biodiversity loss as a source of systemic risk alongside climate change.⁵⁵ Market-led frameworks like the TNFD hope to create momentum to limit damages to nature and drive investments in nature recovery. As such, there are opportunities for businesses to differentiate themselves in the marketplace by driving these changes proactively, rather than only reacting to them.

Shifting Sands: Evolving policy and regulation on the ocean

Examples of evolving policy and regulation on the ocean include

- The Kunming-Montreal Global Biodiversity Framework (GBF) was adopted during the fifteenth meeting of the Conference of the Parties (COP 15) of the Convention on Biological Diversity. It sets out an ambitious pathway to reach the global vision of a world living in harmony with nature by 2050. Among the Framework's key elements are four goals for 2050 and 23 targets for 2030. A headline goal is 30x30 - ensure that by 2030 at least 30% of terrestrial, inland water, and coastal and marine areas, are effectively conserved. Marine Protected Areas (MPAs), and channelling funding to developing countries for MPAs will be a key part of this⁵⁶
- In March 2023, the UN Intergovernmental Conference on Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) agreed a 'High Seas Treaty' that provides a legal framework for establishment and enforcement of MPAs and limits on harmful practices on the high seas beyond the limits of national jurisdiction⁵⁷
- World Trade Organisation's (WTO) agreement to ban some harmful fishing subsidies⁵⁸
- UN Environment Assembly's decision to negotiate a treaty to ban plastic pollution⁵⁹
- A tougher decarbonisation target for shipping is set to be adopted by the International Maritime Organization (IMO).⁶⁰

Are you ready for TNFD?

The Task Force on Nature-related Financial Disclosures (TNFD) provides a cross-sector framework for companies to understand their nature-related risks, impacts, dependencies, and opportunities. It was established in 2021 in response to the growing need to factor nature into financial and business decisions.

What is TNFD?

The TNFD is a global, market-led voluntary initiative. Its mission is to develop and deliver a risk management and disclosure framework for organisations to report and act on evolving nature-related risks and opportunities, with the aim of supporting a shift in global financial flows away from nature-negative outcomes and toward nature-positive outcomes.

The Taskforce will publish its final framework and recommendations in September 2023, and organisations are encouraged to pilot the draft (beta) version now, to manage their nature-related risks and prepare for future disclosure requirements.⁶¹

The Taskforce is made up of 40 senior executives^x from corporates, financial institutions, and market intermediaries from around the world, representing institutions with over US\$20 trillion in assets under management and a footprint in over 180 countries across five continents.⁶²

The TNFD highlights ocean data gaps as a key barrier to constructing metrics to protect marine ecosystems.⁶³

The TNFD is just one example of the fast-changing circumstances that businesses face regarding environmental impacts – and momentum is growing. For now, draft TNFD guidelines outline several common risks and opportunities faced by businesses at the time of writing.

Nature-related risks are split into physical, transition, and systemic risk, as outlined in the Table 2.



^x Including Deloitte's Global Nature Lead Guy Williams.

Table 2: Common risks faced by businesses⁶⁴

Category	Category description	Risk
Physical	The risk of losses caused directly from changes in nature.	Acute risk: short term, event-based risk.
		Chronic risk: risk from long-term changes in environmental conditions.
Transition	The risk arising from to the anticipated continued global shift towards a more sustainable, net zero, nature-positive economy. This can be broad in nature and tend to be highly uncertain.	Policy and legal risk: risk from changes in the legal operational context (such as legislation, regulations, policies).
		Market risk: risk from changing market dynamics such as changes in consumer preferences.
		Technological risk: risk from substitution of products or services with a lower impact/ dependency on nature.
		Reputational risk: risk from changes in perception of a business's actual or perceived impact on nature.
Systemic	The more complex secondary risk that arises from interactions in human networks.	Ecosystem collapse risk: risk from the non-functioning of critical natural systems, can be the summation of physical risk.
		Aggregated risk: risk to one or more whole sectors in a portfolio from increases in physical or transition risk.
		Contagion risk: risk from financial difficulties a subset of financial institutions spilling over to the whole financial system.

Nature-related opportunities are split into business performance opportunities and sustainability performance opportunities, outlined in Table 3.

Table 3: Common opportunities available to businesses⁶⁵

Category	Opportunity	Description
Business performance	Resource efficiency.	Opportunities for improved efficiency and reduced costs as a co-benefit from actions taken in its own operations or value chain to reduce impacts and dependencies on nature.
	Markets.	Opportunities for new markets or locations due to changing market dynamics.
	Capital flow and financing.	Opportunities for improved access to capital markets or financing terms connected to positive nature impacts or mitigation of negative impacts.
	Products and services.	Opportunities for new value propositions that protect, manage, or regenerate nature.
	Reputational capital.	Opportunities from changes in the actual or perceived impact on nature.
Sustainability performance	Ecosystem protection, restoration and regeneration.	Opportunities for activities that protect, restore, or regenerate habitats and ecosystems.
	Sustainable use of natural resources.	Opportunities from substitution of natural resources for recycled, regenerative, renewable and/ or ethically sourced inputs.

The rest of this chapter suggests salient risks and opportunities for each of the four sectors. Some of these are common across sectors but will vary in sources and scale.

Food retail

How do food retailers interact with marine ecosystems?

The food system is highly dependent on marine ecosystems for a range of ecosystem services. Marine ecosystems provide seafood and protection of infrastructure from storms, floods and soil erosion through coastal ecosystems including coral reefs, seagrass meadows, and mangrove swamps. The Food and Agriculture Organization of the United Nations (FAO) estimates that over 500m people rely on fish as their primary source of animal protein. The food system is also reliant on small pelagic fish and algae as fishmeal, baitfish, nutritional supplements, and pet food.⁶⁶

However, the food system is causing global nature and biodiversity loss,⁶⁷ with food retailers operating as the main interface between supply chains and consumers. On the one hand, food retailers face risks from the breakdown of marine ecosystems destroying seafood market supply chains - in 2021 in the UK, seafood sales reached £4.2bn.⁶⁸ On the other hand, food retailers are also closely associated with the impacts of the global food industry on marine ecosystems.

Historically embedded practices of the food retail sector and its suppliers undermine the ocean's ecosystem services, putting food sector supply chains and assets at risk, contaminating seafood and agricultural products, and creating externalities beyond the food sector which creates reputational risk.

Plastic pollution is negatively impacting marine ecosystems, with food retailers being a major source. While food retailers have taken steps to reduce the use of plastic and increase recyclability,

it is estimated that between 19-23m metric tonnes of plastic entered the marine environment in 2016.⁶⁹ Much of it is from food and drink packaging, while a significant proportion in some areas comes from lost fishing gear.⁷⁰ These pieces of plastic can be ingested by marine wildlife and cause their death by blocking or piercing their stomachs. 68% of cetacean species are known to be affected by marine litter.⁷¹ Plastic pieces break down into the ocean to become microplastics which are then ingested by marine organisms as small as plankton. These microplastics travel through ecosystems and food chains, absorbing and retaining toxic pollutants. Toxic microplastics accumulate at the top of food chains in fish and cetaceans. Krill-eating blue whales may ingest up to 10m microplastic pieces a day that weigh about 43kg.⁷² As consumers of fish, these same microplastics end up in us too. There is an economic cost to this plastic pollution. A Deloitte study concluded that marine plastic pollution could have resulted in economic losses between \$6 - 19bn in 2018.⁷³

Bycatch is when unintended animals such as cetaceans are entangled in fishing nets and lines which can lead to their injury or death. The bycatch problem is vast and estimated to make up at least 40% of global fish landings.⁷⁴ It also impacts entire ecosystems - it is estimated that 300,000 cetaceans die every year as a result of bycatch.⁷⁵ Some fishing practices such as bottom trawling and use of gill nets are particularly damaging. Ghost gear is also a significant problem. There are numerous examples of measures to reduce bycatch that can be simple and low cost.

Actions on land can also spill over into the ocean. Fertiliser chemicals in agricultural runoff harm marine ecosystems, causing algal blooms that deplete water oxygen levels in rivers and coastal areas. This can cause 'dead zones' and other major disruptions to affected marine ecosystems through changes in ocean productivity, biodiversity, and biogeochemical cycles.⁷⁶

Cetaceans are interlinked to food retailers in many ways. Cetaceans support and enhance primary productivity in the ocean (see Cetaceans and their role in marine ecosystems) and therefore strengthen the foundations of marine ecosystems that support productive fisheries. While estimates are uncertain, an average blue whale off the coast of Brazil contributes around £300,000 to commercial fisheries over their lifetime.⁷⁷ Food retailers are also linked to cetaceans via the significant impact that the food system has on them through bycatch and indirectly leading to plastic pollution.

Alongside the physical risk arising from the dependency of food retailers on marine ecosystems, the perceived negative impact of food retailers on marine ecosystems creates transition risk that is potentially more significant. This risk includes:

- 1. Higher operating costs:** Changing practices may be difficult, creating risks from higher operating costs for food retailers in the short-term, for example, from changing packaging, increased certification and verification costs for sourcing products, or higher transportation costs. Suppliers, such as fisheries, may need to invest in measures to mitigate their impact on marine ecosystems and cetaceans, increasing their operating costs and prices
- 2. Changing consumer spending patterns:** Increasingly nature-conscious and empowered consumers are changing their spending patterns. This means that brands perceived to have a negative impact on marine ecosystems and cetaceans will lose market share. A Deloitte survey in 2022 found that 40% of UK adults had chosen brands with environmentally sustainable practices/values in the last year⁷⁸

3. Reputation consequences: Companies are increasingly being held accountable for the environmental and biodiversity impacts of their products and practices. Being perceived as a brand that damages marine ecosystems and harms cetaceans can be highly controversial and can tarnish a company's reputation. This can lead to adverse media coverage, consumer boycotts, and loss of customers to competitors, reducing revenue

4. Legal and regulatory consequences: Legal and regulatory frameworks for whole marine ecosystems are likely to strengthen in the future (see the Shifting Sands case study). Businesses that are perceived to be damaging marine ecosystems, such as through bycatching cetaceans, may face restrictions, fines, legal action, and even criminal charges, resulting in significant financial losses. This can have a significant impact on their ability to operate and generate revenue and may cause ocean-impacting businesses along the supply chain to fail, impacting supply of products

5. Access and cost of capital: Changing financial regulations (see TNFD overview) will likely mean that access to capital will be reduced or become more expensive for companies that do not meet new requirements from financiers. New requirements will likely include considering impacts along whole supply chains.



What are the opportunities for food retailers?

There are opportunities to collaborate, take action to reduce these risks, and build resilient ocean-product supply chains, while capitalising on new market opportunities with strategic decision making. The food retail sector acts as a gateway to the food

system, giving it a strong influence on its supply chain and the choices it gives consumers. As such, it is well placed to drive change and lead the rest of the industry towards actions that regenerate rather than degrade marine ecosystems.

Some opportunities can be acted on now to generate value and mitigate risk in the short-term:

- **Continuing to phase down plastic packaging:** Food retailers have been successful in reducing the use of plastic bags (see case study below). But more can be done to tackle plastic pollution. These organisations can lead the way by reducing and eliminating plastic packaging in own-brand products, investing in plastic-free alternatives, moving to low-packaging models like refill systems at counters, and collaborating with competitors and shared suppliers to move whole categories away from plastic packaging. While this may have short-term costs, these actions are likely to increase brand value and reduce the above risks. Governments are also increasingly enacting Extended Producer Responsibility (EPR) legislation.⁷⁹ Food retailers will be important players in operationalising these reforms. Solutions to remove existing plastic waste in the ocean are also available (for example the Great Bubble Barrier) and could be invested in
- **Encouraging and supporting deployment of technology to enhance traceability in the food sector:** An example of this is the use of advanced analytics and machine learning within the seafood supply chain to reduce bycatch while achieving efficiency gains (see advanced analytics case study)

- **Supporting ocean-friendly markets through eco-labelling:** Eco-labelling seafood products gives consumers more information to minimise their impact on marine ecosystems. Where eco-labelling has already been used - such as Marine Stewardship Council (MSC) certification - studies have found that consumers are willing to pay more for these products, meaning that higher prices can be charged. One study found that Japanese consumers were willing to pay up to around 20% more for MSC-eco-labelled salmon over non-labelled salmon.⁸⁰ To unlock these high value market segments, food retailers should ensure that existing labels are accurately represented through adequate audit and assurance, and expand the use of eco-labelling
- **Investing in ocean-friendly projects, for example innovative aquaculture:** An example of this is multi-trophic aquaculture. This combines the farming of multiple species to reduce some of the harmful effects of fish farming, while producing multiple outputs.⁸¹ Another example is farming seaweed (e.g., SeaForester). This shows potential for an underutilised crop that is highly nutritious, absorbs carbon, purifies water, and creates habitats for marine life. It is also fast growing – some species can be harvested in as little as six weeks.⁸² The food retail sector is well placed to support the growth of the industry and promote adoption by consumers. If projects are properly vetted to ensure these benefits can be realised sustainably, then this could unlock a valuable new market that helps to regenerate marine ecosystems.



Case study: Advanced analytics to reduce costs and reduce bycatch

Recent advances in data availability, communication, and data analysis have put advanced analytics within reach for fishers.

By improving fish detection, tracing, monitoring, and reporting, these technologies have the potential to reduce costs and bycatch. McKinsey estimate that if all large-scale fishing companies adopted advanced analytics, they could decrease their operating costs by about \$11bn each year.⁸⁷ At the same time, applying machine learning techniques to underwater footage to detect, classify, and automatically report bycatch could lead to better fishery management through better data quality.⁸⁸

With increased transparency across the whole supply chain leading to increased consumer awareness, this could result in the direct effect of increased market prices of goods that have been sustainably sourced (given consumers' willingness to pay for eco-labelled products) and the indirect effect of brand enhancement.

Some opportunities can be acted on now, but will likely have a longer-term payoff:

- **Developing an organisation-wide nature and ocean strategy:** Organisations can set ambitious nature goals and strategies, that include a comprehensive programme to align products and services with ocean and biodiversity restoration goals. Supporting marine and cetacean conservation can lead to brand enhancement and provide marketing opportunities. This can help to build market share in a fiercely competitive sector. Best practice is to integrate this with a wider planetary strategy that simultaneously addresses emissions, biodiversity loss, and ecosystem degradation, while developing strategy in connection with value chain partners
- **Engaging suppliers and industry initiatives to help drive sector-wide change:** Making voluntary public long-term commitments to reducing impact on marine ecosystems and cetaceans will signal intent to the wider industry. Businesses can go

even further by collaborating closely with partners to deliver these commitments through collective action. Leading industry initiatives can increase the chance of successful action to reduce the above risks and improve relationships with suppliers to resolve issues

- **Engaging governments and regulators to establish the enabling policy framework to help the sector act and invest:** This can be done via EPR frameworks to help drive innovation and investment in sustainable packaging by producers, and public investment in recycling infrastructure to encourage recycling. Another example is engaging governments and existing networks to scale up and manage MPAs effectively. This can minimise mismatches between government expectations and business capabilities in this area, reducing the above risks.



Case study: Single-use plastic carrier bags reduction

In October 2015, the UK government and major supermarkets collaborated to introduce a minimum 5p charge per single-use plastic carrier bag for large retailers.

These bags are difficult to recycle and are damaging to wildlife. This scheme was successful. In 2014, customers at major supermarkets in England used over 7.6bn bags. In 2019-20 this has reduced to 564m. This is a reduction of over 95%.⁸³

This change has widespread consumer support. According to the NGO WRAP, 73% of consumers in England are in favour of the scheme with 95% recognising the wide-ranging benefits to the environment so far.⁸⁴

In 2018, the charge was raised to 10p and extended to all retailers. This was aimed to reduce the estimated 3.6bn single use carrier bags issued by small businesses in 2017.⁸⁵

However, according to the Environmental Investigation Agency (EIA) and Greenpeace, more than 1.5bn plastic 'bags for life' (thicker reusable alternative to single-use bags) were issued in 2019. This was 4.5% higher than in 2018.⁸⁶ A widespread shift away from all plastic bags has the potential for an even greater positive impact.

Shipping

How does shipping interact with marine ecosystems?

The shipping sector is a vital part of the global supply chain. Over 80% of the world's trade is transported by sea with total shipping volumes reaching more than 11.1bn tons in 2019.⁸⁹ The global volume of shipping traffic is increasing, along with the speed and size of the largest vessels.

The sector is engaging with climate change measures. However, some of the world's busiest shipping lanes overlap with and disrupt marine biodiversity hotspots. This directly damages the marine ecosystems it shares the ocean with. This leads to reputational risk and creates negative externalities on other sectors that depend on the ocean.

Ship strikes are known to be one of the leading causes of death

Water pollution, such as oil spills, sewage overflows, and leachate of harmful chemicals creates a variety of health issues for marine life. These include hormone alterations, reduced fertility and reproductive failure, weakened immune systems, cancer, and other diseases. Discharging waste and ballast water from ships also damages marine habitats and disrupts ecosystems by introducing invasive species.

Underwater noise pollution has doubled every decade for the last 50 years.⁹⁰ The global merchant fleet, through noise from ships' propellers and engine, is the biggest contributor. This impacts marine life by disturbing hunting, feeding, rest, and reproduction. In the long run, such disruptions can have serious consequences, including injuries, stress, reproductive and growth issues, or even death.

Vessel collisions also impact marine life. Whales are often unable to get out of a fast-moving ship's path, leading to collisions. Although it is not clear in the literature where these statistics are sourced, Friends of the Sea estimate that over 20,000 whales are killed each year due to collisions with vessels' hulls and propellers.⁹¹ The lack of a substantiated source for this figure highlights the urgent need for universal and reliable data collection. Ship strikes are known to be one of the leading causes of death for endangered and vulnerable whale populations - such as the critically endangered North Atlantic right whales, of which only a few hundred individuals remain.⁹² Ship strikes can also damage the ships themselves, leading to costs of repair, lost revenues while repairs take place, and higher insurance costs.

Cetaceans are particularly impacted by shipping activity. Many of the world's busiest shipping and ferry lanes overlap directly with areas where whales are feeding, giving birth, nursing their young, or migrating, as shown in Figure 4. Noise pollution is particularly harmful as acoustic communication and echolocation are crucial aspects of many cetaceans' lives. Cetaceans rely on sound for hunting, feeding, navigation, rest, communication, reproduction, and migration. Water pollution particularly impacts

Whale superhighways

Whales are highly migratory species, moving across the high seas and through many country's waters twice a year as they travel between their feeding and breeding grounds

KEY

■ Fin Whales	■ Bowhead Whales	■ Humpback Whales	■ Blue Whales	— High traffic shipping routes
■ Gray Whales	■ North Atlantic Right Whales	■ Sperm Whales	■ Southern Right Whales	Global shipping routes intersect with whale superhighways, presenting serious risk of collision, noise and other pollution

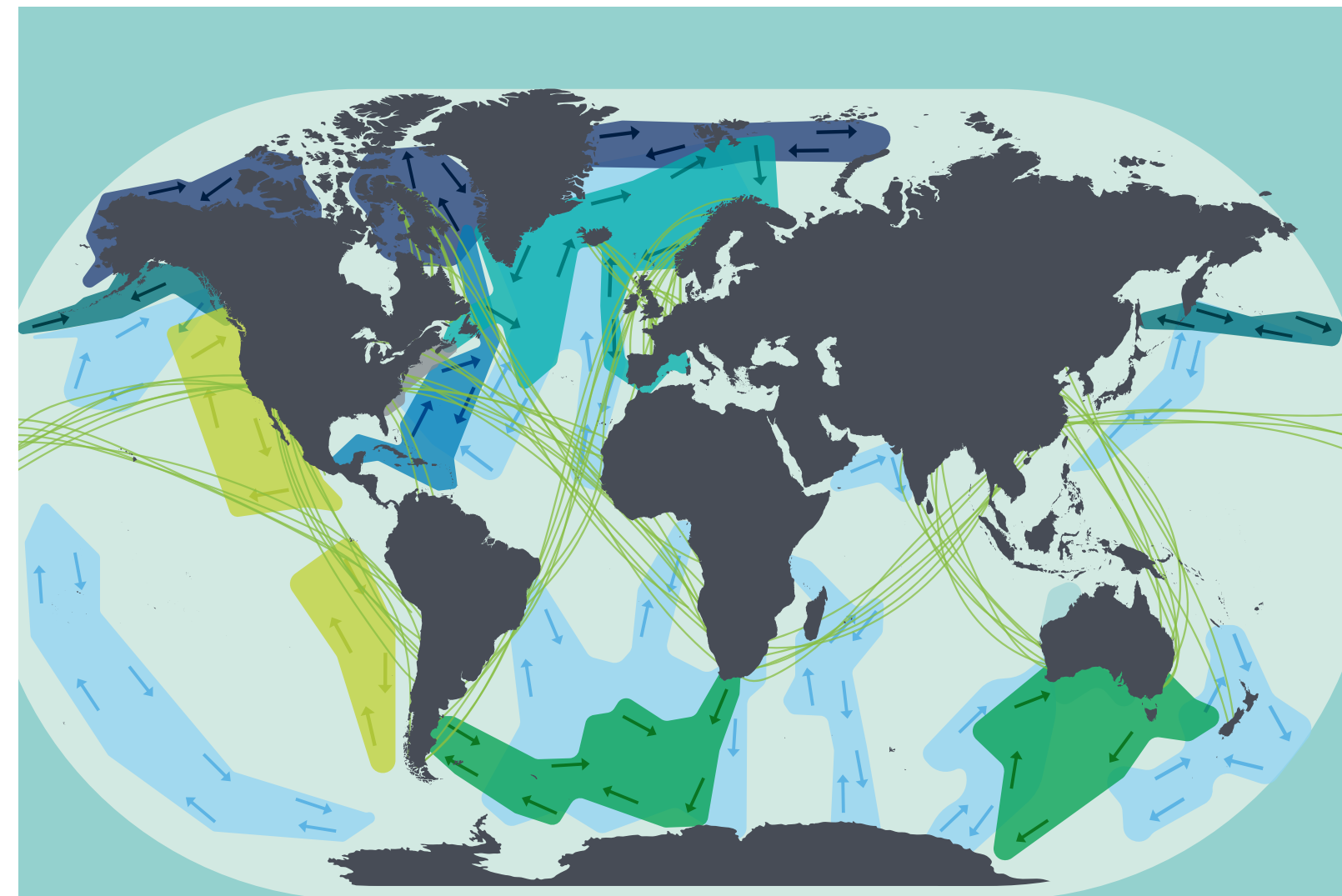


Figure 4: Whale Superhighways

whales by causing respiratory problems and higher calf mortality. Given these elevated impacts, and cetaceans' role in supporting wider marine ecosystems, the shipping sector has extra cause for concern with regards to cetaceans.

While the physical risk to the shipping sector may be relatively small, the perceived negative impact of the shipping sector on marine ecosystems creates transition risk that is potentially more significant. This transition risk includes:

- **Access and cost of capital:** Changing financial regulations (see What is TNFD?) will likely mean that access to capital and insurance will be reduced or become more expensive for companies that do not meet new requirements from financiers
- **Legal and regulatory consequences:** Governments are increasingly concerned about the global nature crisis and working together to combat it. For example, in December 2022 the Kunming-Montreal Declaration was signed by 196 governments at COP15 of the Convention on Biological Diversity. Businesses that are perceived to be damaging marine ecosystems may in the future face restrictions, fines, legal action, and even criminal charges, resulting in significant financial losses
- **Higher operating costs:** Changing practices and investing in technical solutions to mitigate impacts on marine ecosystems creates short-term risks from higher operating costs. This may result in reduced competitiveness as shipping is cost-driven, especially in this high-competition and low-margin sector
- **Reputation consequences:** Companies are increasingly being held accountable for the environmental and biodiversity impacts of their practices. Being perceived as a business that damages marine ecosystems and harms cetaceans can be highly controversial and tarnish a company's reputation. This could lead to loss of core customers, as major companies work to address their own impacts on nature, reducing the income for the company

- **Geopolitical risk causing fragmentation of supply chains:** Differences in attitudes and progress on nature across national governments could cause an increase in trade barriers and the fragmentation of global supply chains. This could reduce the demand for shipping. Further marine ecosystem damage is likely to fuel this risk.

What are the opportunities for shipping?

There are opportunities to reduce these risks with strategic decision making. The shipping sector is taking steps to reduce its environmental footprint in terms of carbon emissions and impacts on nature. However, it could go further and faster to reduce its impact on marine ecosystems. The sector is likely to face increased demands from customers who are assessing nature impacts within their supply chains, especially from larger consumer-facing clients.

Some opportunities can be acted on now, but will likely have a longer-term payoff:

- **Reviewing vessel routes:** Separating ships from marine biodiversity hotspots by employing permanent or seasonal place-based management measures. Examples include the International Maritime Organization's (IMO) routing measures, such as the official designation of Particularly Sensitive Sea Areas, Areas to Be Avoided, Traffic Separation Schemes and Separation Zones or the moving of traffic lanes away from important cetacean habitats. Small changes can have a big impact. This can be seen with the Traffic Separation Scheme in the Bay of Fundy being shifted by four nautical miles. The Canadian Whale Institute (CWI) estimates that the risk of a vessel colliding with a right whale was reduced by 90% in areas where the shipping lanes overlapped with high concentrations of whales.⁹³ New technologies such as high-definition satellite imagery combined with AI can identify individual cetaceans to verify travel corridors. This could be integrated into navigation systems to reduce ship strikes

- **Reducing vessel speeds:** In California, the shipping industry is participating in a voluntary vessel speed reduction program in specific busy areas, upon requests from The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Coast Guard. The aim is to reduce the risk of ship strikes on whales within local national marine sanctuaries. Reducing vessel speeds could also lead to significant savings on fuel and reduce carbon emissions⁹⁴
- **Reducing noise:** This can be achieved by deploying noise reduction technologies, including technical adaptations to vessel design (e.g., propellers, engine and other machinery, and hull design). Reducing vessel speeds and removing biofouling also contributes to decreased underwater noise pollution. This is because a smoother movement of hulls and propellers creates fewer bubbles and less cavitation, which in turn reduces noise. Alongside noise reduction, regular hull cleaning can reduce fuel consumption by around 10-15%.⁹⁵

Some opportunities can be acted on now, but will likely have a longer-term payoff:

- **Developing an organisation-wide nature (and ocean) strategy:** Setting ambitious nature goals and strategies, that include a comprehensive programme to align with ocean and biodiversity restoration goals. This can lead to brand enhancement and marketing opportunities. This can help build market share in a fiercely competitive sector. It is best practice to integrate this with a wider planetary strategy that simultaneously addresses emissions, biodiversity loss, and ecosystem degradation, while developing strategy in connection with value chain partners
- **Increasing conservation knowledge by supporting research efforts:** Management actions should be based on best available knowledge (scientific, local, and indigenous) of marine ecosystems and individual species. Shipping operators could partner with researchers and conservation NGOs to monitor marine ecosystems to generate data and metrics, including real time information that can inform decision making to minimise impact

- **Encouraging industry initiatives:** In areas where place-based measures are not enough, encouraging certification or participation in port-led incentive schemes and the development of quantifiable noise-reduction targets and/or noise thresholds to regulate shipping. Examples of industry-led initiatives focused on protecting cetaceans:

- **Certification programs:** Several certification programs such as the Energy Efficiency Design Index (EEDI) and Green Marine offer incentives for ship owners and port authorities to adhere to environmental standards
- **Ports modelling best practice to reduce ship strikes and noise pollution:** Helyx won the Deloitte GRAVITY challenge in 2021 for their solution to optimise satellite and environmental data, while minimising vessel strikes on marine mammals during port approach and departures⁹⁶
- **Classification societies:** Shipping classification societies are licensed by flag states to classify and certify marine vessels based on their structure, design, and safety standards
- **Fleet and company protocols:** Individual fleets and companies may have protocols to deal with interactions with marine species in their operations, such as encounters with cetaceans. These efforts are a part of broader Corporate Social Responsibility (CSR). They can include voyage planning, use of mariner guides, reporting of encounters and protocols to modify operations.

Case study: Maersk

Maersk have clear and ambitious environmental goals. They aim to become leaders in decarbonising logistics and align with the Science Based Targets initiative 1.5°C pathway by 2030. As part of Maersk's overall ESG ambitions, they are also taking steps to protect marine ecosystem health and biodiversity.

Maersk have altered its vessel speeds and routes to reduce their impact on marine ecosystems. Alongside complying with all mandatory restrictions for marine protected areas, Maersk have increased its engagement with World Shipping Council and the wider industry to map new voluntary protection zones. For example, together the industry have voluntarily moved shipping routes 15 nautical miles further off the south coast of Sri Lanka to reduce collisions with resident blue whales. It is estimated that this change could reduce the chance of collisions by 95%.⁹⁷ Maersk are adding both mandatory and voluntary protection areas to their digital route planning tool, allowing the areas to be geofenced to ensure compliance. Maersk are open to sharing their procedures related to whale protection measures with industry peers via World Shipping Council for greater ecological and societal benefit.

Maersk are collaborating with scientists and experts to improve the monitoring and understanding of the health of our ocean. For example, 60 of Maersk's vessels are equipped with automated weather stations that share live data with the National Meteorological Service of Germany used for forecasting and climate change monitoring. Maersk also support Ocean Cleanup, an NGO developing technology to intercept and extract plastic pollution in oceans and rivers. Finally, Maersk have launched an Underwater Radiated Noise study to research the link between underwater noise and marine life. By engaging with experts and academia, Maersk aim to pursue initiatives to reduce underwater disruption.

Together, these actions demonstrate some of the opportunities for shipping operators to reduce their impact on marine ecosystems, reduce their nature-related risk, and differentiate themselves from competitors.



Finance

How does finance interact with marine ecosystems?

Finance flows support and enable economic activities across all sectors of the economy, for example through investment, lending, and insurance. Over half of global GDP is moderately or highly dependent on nature and its services.⁹⁸ Therefore, the outlook and resilience of the finance system is partly dependent on nature.

Marine ecosystem services underpin numerous marine and coastal industries in the Blue Economy – such as providing seafood to support the food system, creating opportunities for tourism and recreation, while protecting coastal real estate from flooding and storms. The ocean also regulates the climate, capturing 25% of carbon dioxide emissions.⁹⁹ The finance sector should consider damage to marine ecosystems as a key risk to their portfolios, particularly given the link between biodiversity loss and climate change.

Financiers have been keeping a close eye on whales for decades – but not the cetacean kind. In finance circles “whales” are large or influential investors who can have the ability to move markets. Real-life cetaceans also provide a range of services that directly support economic activity, such as whale watching. Keystone species, such as the great whales, also play an important role in maintaining primary productivity and resilience in marine ecosystems (see Whale Pump figure) – they indirectly support the wider Blue Economy. While not directly dependent on them, these wide-ranging effects and their charisma mean that the finance sector has extra cause for concern for cetaceans.

Human activity is significantly damaging marine ecosystems across diverse sectors of the economy. This creates physical risk for the finance sector in three ways.

Firstly, there will be a direct effect on the performance and viability of investments and loans to dependent industries, such as the food system and tourism. Secondly, there will be an indirect effect across the value chain of these industries, including hotels, restaurants, marinas, and vessel repair. Thirdly, these risks will be compounded by the loss of the climate regulation services that these marine ecosystems provide. Increased frequency and severity of extreme weather events, rising sea levels, and ocean warming will have wider impacts on numerous sectors that are peripherally connected to the ocean such as coastal real estate.

The finance sector is a major enabler of harm to marine ecosystems, putting invested capital in ocean-dependent sectors at risk as well as accelerating negative externalities that impact the whole economy, creating reputational risk.

Funding is overwhelmingly flowing towards activities that damage ocean health and cause these physical risks. Investment patterns, lending, and subsidies continue to promote unsustainable resource extraction and rapid growth in marine industries without measures to mitigate damages. For example, current financial flows drive some of the biggest threats to cetaceans. These include insuring shipping that leads to ship strikes, investing in plastics and chemical manufacturing that ends up being ingested, and lending to fisheries that cause cetacean bycatch.

“We need a systems change to a nature-compliant economic model, and we need it now. Ocean and its health is a macro essential and we should avoid seeing the Ocean as the last frontier for exploration and exploitation. A sustainable and equitable transition is key for the Blue Economy, without taking away its ability to support life on Earth.”

Markus Müller, Managing Director, Chief Investment Officer ESG, Deutsche Bank

A historic neglect of nature means there has been little appetite to invest in the conservation of marine ecosystems. As Deloitte’s Drop in the Ocean report highlighted, the best available estimate puts the amount of climate finance received by nature at less than 3% of the total. For the ocean, it is less than 1%.¹⁰⁰

However, the landscape is shifting. Increased pressure is coming from governments, regulators, markets, and consumers to align finance with conservation goals, and start to understand, assess and disclose their financed impacts on nature across their portfolios in the same way that finance firms need to assess and disclose their financed greenhouse gas (GHG) emissions.

While the physical risk to the finance sector may be relatively small, the perceived negative impact of the finance sector on marine ecosystems creates transition risk that is potentially more significant. This transition risk includes:

- **Risk of stranded assets and lower return on investments:** Financial institutions are largely unaware of the impacts on marine ecosystems across their portfolios. This is a risk as ocean-impacting assets found to be damaging marine ecosystems may become stranded, leading to lower investor returns. Not recognising impacts is also a major barrier to aligning finance with ocean conservation and regeneration goals. Furthermore, measuring, reporting, and reducing impacts and dependencies on marine ecosystems may require significant investments in new technologies, infrastructure, and practices.

This could negatively affect operating costs, revenues, and enterprise value in portfolios. WWF estimates that \$8.4 trillion of ocean-based assets are at risk from declining ocean health and climate change¹⁰¹

- **Legal, regulatory, and compliance consequences:** Governments are increasingly concerned about the nature crisis. Nature risk is now seen as part of financial regulators’ and central banks’ mandate due to its potentially significant macroeconomic implications and impact on the financial system. Markets are also responding, notably with the development of industry-led initiatives such as the TNFD, which is creating a framework that helps companies and finance institutions to assess, manage and disclose their nature-related risks and opportunities. Businesses that are perceived to be damaging marine ecosystems or do not meet compliance obligations may, in the future, face restrictions, fines, legal action, and even criminal charges, resulting in significant financial losses
- **Reputation consequences:** Governments and international organisations are increasingly looking to enact more stringent regulations and reporting standards for ocean-impacting enterprises involved in areas such as shipping, fisheries, aquaculture, and tourism. Financial institutions supporting sectors that damage marine ecosystems may also face reputational risks if they are associated with unsustainable and/or illegal practices. This can lead to adverse media coverage, boycotts, and loss of customers (retail and corporate), reducing their income.

What are the opportunities for finance?

There are opportunities to take action to reduce these risks and capitalise on new market opportunities with strategic decision making. Businesses in the major ocean-impacting sectors such as food retail, fishing, shipping, and marine renewable energy play an important role in reducing their impact on marine ecosystems.

But the finance sector – including public and private institutions – is in a unique position to influence and accelerate this transition

through strategic lending, underwriting and investment activities, as well as its client relationships.¹⁰²

Some opportunities can be acted on now to generate value and mitigate risk in the short-term:

- **Identifying and assessing organisational nature-related (and ocean-related) risks:** Most financial institutions are largely unaware of the extent their investments and lending are affecting nature; fewer will have considered marine ecosystems. Organisations can start to pilot the TNFD's current beta (draft) framework now by identifying the dependencies and impacts associated with their portfolios on nature and the ocean. Many are already doing so. Over 100 active pilots are currently underway across a range of finance institutions and corporates globally. A key challenge will be access to quality data and metrics for decision making, a recognised gap for marine ecosystems. As with the TNFD's climate cousin the Task Force on Climate Related Financial Disclosures (TCFD), it seems likely that the TNFD will soon become leading practice or even mandatory

- **Eliminating financed impacts on nature (and the ocean) from portfolios:** Reducing transition risk exposure can be achieved through direct divestment or portfolio stewardship and shareholder advocacy. Institutions could consider using the Sustainable Blue Economy Finance Principles as a framework to help guide the process of aligning portfolios with sustainable ocean goals. While embedding nature into business practices may be difficult – needing time, collaboration, investment, new data and tools, and commitment at all levels of governance – the benefits from reduced risks to portfolios will likely far outweigh this.

“Nature-positive solutions will create \$10.1 trillion in business opportunity and millions of new jobs”

(World Economic Forum, 2020)

- **Investing in “blue carbon” projects:** Opportunities already exist to align investments to environmental sustainability goals. For example, the restoration of mangroves, seagrass and saltmarshes is a rapidly expanding market opportunity for nature-based solutions to support net zero and environment goals. Cetaceans, with their ability to capture ocean carbon, offer an untapped opportunity for investment in a new asset class.¹⁰³ Initial estimates suggest the direct carbon value of a blue whale is £28,000 and the indirect carbon value (through their ecosystem services) could be up to £2m, although this latter figure is subject to significant uncertainty.¹⁰⁴

Some opportunities can be acted on now, but will likely have a longer-term payoff:

- **Creating new nature-positive markets and mobilising capital to invest in them:** Finance institutions are ideally placed to collaborate with other market players to help scale these markets. Protecting marine ecosystems presents opportunities for innovative products and services alongside new architectures to ensure credible, robust, and verifiable outcomes. The recent Our Ocean Conference March 2023 highlighted exciting new initiatives, alliances – such as Ocean Risk and Resilience Action Alliance (ORRAA) – tools and innovations that exist in every blue sector. As Deloitte's Drop in the Ocean report highlighted, around \$175bn per year is needed to conserve the ocean. With levels of investment currently at around \$25bn, this equates to an annual funding gap of around \$150bn.¹⁰⁵ However, this is not due to a lack of funds available for investment but uncertainty around where to invest. All financial institutions can mobilise wider financial capital markets by sourcing investible ocean projects, developing blended finance models, and scaling new instruments like funds and bonds. Governments can also play a key role by crowding in private finance by aligning regulation, fiscal policy, subsidies, and investment with ocean restoration goals
- **Using networks and influence to accelerate transition in other sectors:** Forward-thinking financial institutions can use their influence in several ways. These include through new products and services, working with companies invested in, and making access to capital contingent on good practices – to accelerate the transition. Dialogues with executive teams and boards on creating robust organisation-wide nature strategies can also help to reduce impacts on nature and therefore nature-related risks in financial portfolios.

Sustainable Blue Economy Finance Principles

Prince of Wales's International Sustainability Unit, the European Commission and the European Investment Bank, WWF have developed a set of voluntary sustainable Blue Economy Finance Principles to act as a framework for investment and development policy decisions.

These principles complement existing frameworks in sustainable finance and recognise the importance of compliance, transparency, and disclosure, as well as the specific challenges of investment in the context of the ocean. They are designed to support the Sustainable Development Goals (SDGs), in particular Goal 14 (“Conserve and sustainably use the ocean, seas and marine resources for sustainable development”).

They are also designed to be compliant with the International Finance Corporation's (IFC) Performance Standards and European Investment Bank's (EIB) Environmental and Social Principles and Standards.

Tourism

How does tourism interact with marine ecosystems?

Tourism is one of the largest and fastest-growing industries in the world. In 2019, it made up 10.3% of global GDP according to the World Travel & Tourism Council.¹⁰⁶ Coastal and marine tourism constitutes approximately 50% of all global tourism.¹⁰⁷ By 2030, it is projected to be the largest value-adding segment of the ocean economy, at 26%.¹⁰⁸

Coastal and marine tourism is also a major component of thriving coastal communities. It boosts local economies as a long-term source of jobs and revenues. Visitors participating in coastal and marine tourism are likely to stay in the area, support local hospitality, and engage in other tourism activities. A thriving coastal and marine tourism sector is often a source of pride in these communities.

Experiencing marine ecosystems, such as by snorkelling, kayaking, and wildlife watching, is a major part of the coastal and marine tourism industry. The business case for coastal and marine tourism operators to protect these marine ecosystems is simple. The **improved health of marine ecosystems directly improves the quality and value of visitor experiences.** Widespread healthy marine ecosystems would also mean less visitor crowding (increasing experience quality further), ensure benefits are spread over more communities, make more room for successful operators, and see reduced risk from disasters or ecological changes.

The rapid growth in tourist numbers has pushed humans ever further into new pristine natural environments, endangering marine ecosystems. There are countless examples of how unsustainable marine tourism endangers marine ecosystems and destroys the very natural assets on which the industry depends.

The business case for preserving marine ecosystems that underpin tourism offerings is clear, but in this fragmented industry, smaller players cannot do this alone. There is a role for large and small organisations, and governments to collaborate and coordinate a joint response.

Litter is brought to the ocean by coastal tourists. This can be one of the primary land-based sources of marine litter.¹⁰⁹ Litter is a visual blight that worsens visitor experiences. A study in Brazil estimates that significant litter on beaches would reduce local tourism income by around 40% and deter 85% of users.¹¹⁰ It also harms the marine wildlife that ingests it - potentially causing their death by blocking or piercing their stomachs. 68% of cetacean species are known to be affected by marine litter.¹¹¹ Plastic litter is particularly harmful as pieces break down into the ocean to become microplastics. These microplastics travel through entire ecosystems and food chains, absorbing and retaining toxic pollutants. Toxic microplastics accumulate at the top of food chains in fish, cetaceans, and humans.



Tourists also disturb marine wildlife with the noise, light, and water pollution they produce. This can have adverse impacts on the behaviour of some species, such as feeding or resting. This could reduce marine wildlife health in the long-term, especially in situations where there is prolonged or repeated exposure.¹¹² For example, disturbance is linked to cetaceans abandoning their preferred habitats leading to a decline in their health and populations.

Collisions with boats injure and often kill marine wildlife. Long-distance ferries and cruise ships cause collisions with wildlife such as whales, who are often unable to get out of a fast-moving ship's path. Wildlife-watching vessels can also collide with the animals they are searching for, especially in areas where there is a high intensity of traffic, such as off the coast of Massachusetts or Hawaii.¹¹³

The tourism sector also has a range of positive impacts on marine ecosystems. Responsible wildlife-watching can support education about the ocean. It can also have a profound effect on visitors in terms of raising awareness of environmental issues and increase engagement with conservation activities. Where tourism enables local communities to benefit (i.e., community-based tourism), this creates a powerful incentive to protect the natural assets that attract tourists.

The case of cetaceans and the whale watching industry is useful to illustrate these points. Cetaceans are charismatic animals, and there is a strong ecotourism industry associated with them. Whale watching has a global economic contribution illustratively estimated at £3.1bn annually to coastal and wider economies.¹¹⁴ However, cetaceans can be negatively affected by whale watching through ship strikes and disturbances. Given their roles in regulating our seas and sustaining marine ecosystems, there is extra reason for the sector to have a particular cause for concern regarding cetaceans.

Alongside the physical risk arising from the dependency of the tourism sector on marine ecosystems, the perceived negative impact of the tourism sector on marine ecosystems creates transition risk that are potentially more significant. This transition risk includes:





What are the opportunities for tourism?

- **Higher operating costs:** It will be difficult to change practices to reduce impacts on marine ecosystems, creating short-term risks from higher operating costs. Protecting marine ecosystems may mean limiting visitor access to MPAs. For example, the world-renowned diving island of Sipadan in Malaysia has restricted access to tourists in numerous ways. In 2005, all dive resorts were relocated to nearby islands an hour away by boat. Access is limited to 176 divers per day, controlled by permits through the Sabah Parks Government. From 2020, the island is closed for one month each year to allow the marine ecosystem to recover.¹¹⁵ Due to the global nature of coastal and marine tourism, this could mean reduced competitiveness compared to other regions or countries with similar natural assets. This would have a direct impact on revenues, business viability, and local communities
- **Changing consumer spending patterns:** Increasingly nature-conscious and empowered visitors may change their spending patterns. This means that countries and operators who are perceived to have a negative impact on marine ecosystems and cetaceans will lose visitors
- **Reputation consequences:** Similarly, being perceived to be damaging marine ecosystems and harming cetaceans can be highly controversial. It can tarnish an operator's or country's reputation. This can lead to adverse media coverage, boycotts, and loss of visitors, reducing income for operators and for local communities. Companies are increasingly being held accountable for the environmental and biodiversity impacts of their practices
- **Legal and regulatory consequences:** Legal and regulatory frameworks for whole marine ecosystems are likely to strengthen in the future (see Shifting Sands case study). Operators that are perceived to be damaging marine ecosystems may face restrictions, fines, legal action, and even criminal charges, resulting in significant financial losses. Tourism operators directly interface with marine ecosystems so this risk may be particularly significant. This can have a substantial impact on their ability to operate and generate revenue
- **Access and cost of capital:** Changing financial regulations (see What is TNFD?) will likely mean that access to capital will be reduced or become more expensive for companies that do not meet new requirements from financiers. Compliance with new requirements may be particularly challenging for tourism operators due to the lack of data on the ocean.

There are opportunities to take action, reduce these risks, and capitalise on new market opportunities with strategic decision making. With anticipated annual global growth rates of more than 3.5%, it is vital that the coastal and marine tourism sector centres nature and aligns activities and investment with nature recovery goals to continue to thrive.¹¹⁶

For example, there is much scope for the whale watching industry to continue growing. In 2030 it is illustratively estimated that the global economic contribution of whale watching could reach £4.9bn, with disproportionate growth opportunities in developing nations.¹¹⁷ This is also an opportunity for whaling nations to fully realise these benefits, provided they stop whaling, as whales left to live freely in the wild will likely provide higher economic benefits. Future growth is partly dependent on a growing cetacean population and therefore distribution, given the possible negative effects of visitor crowding of popular whale watching sites (in terms of the animal welfare and customer demand). Detrimental effects from carbon emissions, crowding, pollution and other unsustainable tourism activities put this growth at risk and should be carefully managed.

In addition to the actions that businesses can take, the tourism sector presents opportunities for policymakers - particularly those that have made commitments to the UN High Seas Treaty. Local ecotourism, typically run by small businesses, provide tourist activities that depend on and celebrate marine biodiversity. Managing these appropriately offers opportunities for an equitable transition for local communities, by protecting their resources, promoting job creation, and supporting the resilience of coastal economies.

Some opportunities can be acted on now to generate value and mitigate risk in the short-term:

- **Developing and adhering to sustainable tourism codes of conduct:** Operators can work together to directly reduce their impact on marine ecosystems by adhering to strong environmental care standards. For example, Whale SENSE (see case study) certifies responsible whale watching operators, while Green Fins provides guidance and certification for snorkelling and scuba diving operators. Best practice is for whale watching areas to adopt an adaptive management approach – where local stakeholders and authorities collaborate to share information, expertise, and responsibility when protecting cetaceans.¹¹⁸ Standards can include:
 - Introducing operational procedures such as rerouting vessels, introducing speed limits, distance requirements, and disseminating information on vessel strikes
 - Considering certain questions regarding the tour operations including:
 - Is the cetacean population growing?
 - Are cetaceans moving out of the area?
 - Are cetaceans exhibiting changes in behaviour?
 - How are cetaceans using this area (e.g., breeding, calving, feeding, resting) and what impacts should this have on interactions with them?
 - Are cetacean tourism operators knowledgeable about them?

- Contributing to cetacean protection and conservation – for example, assisting local scientists or promoting conservation initiatives
- Providing accurate education about cetaceans and their associated habitats for tourists in advance of and during trips
- Offering benefits to the local host community the company operates in. Examples of such benefits might include a company policy of preferential employment of local people, selling local handicrafts, or supporting conservation, educational, or social and cultural projects or activities in the local community
- **Driving industry-wide action to reduce pollution and carbon emissions:** For example, operators can reduce their damage on marine ecosystems while attracting more visitors by preventing litter from entering the ocean and removing litter that is already there. This could be as simple as providing adequate bins, recycling, and composting facilities. Though, this will require adequate waste infrastructure to process this. Environmental entry tickets, levies or taxes on tourists can open up a source of sustainable funding to do this, while helping to directly share the benefits with nature and the local community. Transparency should be a clear principle with these initiatives
- **Integrating volunteering and education experiences with tourism:** There is evidence that tourists want to take on more active roles when learning about and caring for the natural assets in destinations that they visit.¹¹⁹ Some operators are already going one step further than minimising their impact by offering innovative ecotourism opportunities that enhance visitor experiences, and educate guests, while protecting marine ecosystems. For example, whale watchers could be given the chance to remove marine litter from the beaches where they encounter cetaceans. Expanding these offerings will help to shift mindsets from resource-extraction to nature-caring with generating value.

Some opportunities can be acted on now, but will likely have a longer-term payoff:

- **Fostering alliances between tourism operators, NGOs, researchers, and citizen science to assess marine ecosystem health:** Wide and consistent data collection is needed to build metrics, inform policy, target investment, and ensure marine ecosystem management is effective. By partnering with education and research organisations such as ORCA, operators can build better visitor experiences too. Operators are often in the best position to lead these multidisciplinary partnerships, as they can maximise visitor satisfaction while reaching environmental protection goals¹²⁰
- **Championing marine ecosystems to other sectors:** As the whole tourism sector becomes increasingly aware of its dependence on marine ecosystems, it could use its influence and global reach to drive nature-positive change in other industries. It could start with influencing its own supply chains (such as hotels, airlines) to minimise their impact on marine ecosystems, before turning to adjacent sectors. Our cetacean ocean ambassadors will be powerful allies to do this.



Case study: Whale SENSE¹²¹

Whale Sense is a voluntary best-practices program sponsored by the National Oceanic and Atmospheric Administration (NOAA) and WDC.

Whale Sense is based in the US and recognises companies every year that promote responsible whale watching practices that allow whales to engage in natural behaviour without interference. This provides consumers with the ability to differentiate between competitors and choose experiences that do not harm cetaceans.

For example, in the Atlantic region, some of the conditions for companies seeking Whale Sense recognition are: provide educational content onboard vessels, comply with applicable laws, report whales in distress, follow NOAA's policies to prevent harassment, exceed existing standards to promote stewardship, participate in Whale Sense training and participate in an annual evaluation.

Case study: Silversea

Silversea recognise that sustainable tourism means offering tangible benefits to the local communities they visit.

In 2019, they launched the Silversea fund for the Galapagos in partnership with Galapagos Conservancy. 80% of funds raised contribute to local education while the other 20% goes to other conservation efforts.

Most education funding supports the Scalesia Foundation, a non-profit that supports learning among children in the local community. At the core of Scalesia is the Tomás de Berlanga school which offers around 220 students bilingual education focusing on a curriculum that emphasises sustainability principles. Previously these students would have had to travel to mainland Ecuador.

Silversea explain and present the Scalesia Foundation to all guests who travel with them to Ecuador. To further encourage donations, Silversea then match all donations in the form of a Future Cruise Credit up to the value of \$1000 per suite.

Through this, Silversea ensure the benefits of marine tourism also accrue to local communities. This ensures that the incentives to protect the marine ecosystems that underpin this tourism are also shared, reducing their risk of harm.

Calls-to-action

The following calls-to-action are made on the basis of the analysis contained in this report. They have been developed in collaboration with WDC and industry stakeholders.

Iterate along a biodiversity positive pathway:

- **Understand the value of the ocean and your relationship with it.** Assess how you and your value chain depend on marine and coastal systems. What sort of impact do you have on them? What risks and opportunities come with this dependency? Organisations are encouraged to better understand their relationship with the ocean by using the TNFD framework
- **Develop a net zero, biodiversity positive transition plan that integrates action to protect and invest in ocean recovery.** Become an ocean ambassador by identifying ways to shift your business assets, operations, investments, and value chains away from damaging the ocean, including deep ocean. Seek out opportunities to invest in ocean-based solutions to help you meet your climate and biodiversity goals. Read *A Drop in the Ocean* to learn more about investing in ocean recovery¹²²
- **Commit to ambitious goals and science-based targets on climate and biodiversity.** Make meaningful, informed, and public commitments, while setting science-based net zero and nature positive targets that incorporate your contribution to restoring the ocean, including deep ocean. For guidance, review Science Based Targets initiative (SBTi) and Science Based Targets Network (SBTN). Continued iteration and engagement will be needed to bolster and support frameworks that are less developed (e.g., for the deep ocean)
- **Embed climate and biodiversity goals into your business, commercial and risk management frameworks, and processes.** Mainstream sustainability and build capacity at all levels to achieve meaningful change and leverage the opportunities from a sustainable transition.



- **Report publicly on your biodiversity-related risks and opportunities and how you are responding.** Prepare for meaningful biodiversity reporting that highlights exposure and mitigating actions taken by developing, embedding, and advocating marine conservation goals and targets.
 - **Actively seek external partnerships.** Look beyond your sector for solutions, innovations, and opportunities for collaboration to help restore the ocean and coasts, while protecting cetacean populations. Working with experts in the NGO sector, academia and local communities will be critical to understand the ocean and develop your strategy
 - **Advocate for ambitious government policies that will help businesses to scale and speed up action on ocean recovery.** This includes encouraging and holding governments to account on implementation of commitments and supporting legal/regulatory mechanisms in the Global Biodiversity Framework (GBF) and Global Oceans Treaty.
- Look outwards to maximise your impact:**
- **Support data collection and leverage associated benefits.** Invest in deploying innovative technologies that collect and process data to improve operations, mitigate impact and support research. Data is fundamental for developing best practice, quantifying the benefits of investment and helps improve public reporting
 - **Collaborate within your sector to drive wider change.** Improve industry standards and develop new investment models to accelerate the creation of markets for nature's services and attract ocean finance. Also improve availability, access to, standardisation, and quality of data through utilisation of enabling technologies and open-source data sharing with all stakeholders

Conclusion

WDC remind us that we cannot beat the climate and biodiversity crises without protecting the ocean, and we cannot protect the ocean without saving whales and dolphins. We can all become ocean ambassadors, gather more data, fill knowledge gaps, accelerate progress, and make an impact that matters by seeking ambitious and collaborative ways of working. WDC are keen to engage with organisations that are keen to create impact and make a difference to the world around them.

This report aims to shine a light on the importance of our ocean; a vital but overlooked part of our planet. It presents a framework to help structure thinking about the true value of living species and uses cetaceans to showcase the diverse ecosystem services that nature provides.

It also discusses several risks arising from the degradation of marine ecosystems for four key sectors, related opportunities, and finishes with calls-to-action. These calls-to-action aim to move the conversation and inspire action, rather than providing exhaustive specific remedies for the biodiversity crisis. The potential for businesses, industries and government to safeguard our marine environment is as vast as the ocean itself.

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Glossary

Term	Definition
Aquaculture	The farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants, involving interventions such as regular stocking, feeding, protection from predators, to enhance production. ¹²³
Ballast water	Water carried in ships' ballast tanks to improve stability, balance and trim. It is taken up or discharged when cargo is unloaded or loaded, or when a ship needs extra stability in foul weather. When ships take on ballast water, plants and animals that live in the ocean are also picked up. ¹²⁴
Biodiversity	The variability among living organisms and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. ¹²⁵
Biofouling	The accumulation of aquatic organisms such as micro-organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. ¹²⁶
Biomass	In the context of ecology: the mass of organic material originating from plants, animals and micro-organisms in a given area or volume. ¹²⁷
Blue carbon	Biologically-driven carbon fluxes and storage in marine systems that are amenable to management. E.g. coastal blue carbon focuses on rooted vegetation in the coastal zone, such as tidal marshes, mangroves and seagrasses. ¹²⁸
Blue economy	While there is no agreed definition, this term is used here to mean the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem. ¹²⁹
Bycatch	The incidental capture of non-target species. The portion of a commercial fishing catch that consists of marine animals caught unintentionally. ¹³⁰
Carbon sequestration	The long-term storage of carbon in plants, soils, geologic formations, and the ocean. Carbon sequestration occurs both naturally and as a result of anthropogenic activities and typically refers to the storage of carbon that has the immediate potential to become carbon dioxide gas. ¹³¹
Cetaceans	The infraorder covering whale, dolphin and porpoise species.
Climate	In a narrow sense, climate is usually defined as the average weather over a period of time ranging from months to thousands or millions of years. Climate in a wider sense is the state of the climate system. ¹³²

Term	Definition
Climate finance	There is no agreed definition of climate finance. The term is applied to the financial resources devoted to addressing climate change. Climate finance aims to reduce net greenhouse gas emissions and/or to enhance adaptation and increase resilience to the impacts of current and projected climate change. ¹³³
Deep sea	Generally defined as the depth at which light begins to dwindle, typically around 200 meters. ¹³⁴
Ecological	Related to the interrelations of the diversity of life, the abundance of life forms, and the interplay of their activities within and between life forms and the physical environment. ¹³⁵
Ecosystem	A dynamic complex of plant, animal and microorganism communities and sometimes the non-living environment, interacting as a functional unit. ¹³⁶
Ecosystem services	The contributions of ecosystems to the benefits that are used in economic and other human activity. ¹³⁷ In this report, contributions to the intrinsic value of the ocean and its marine ecosystems are also included.
Extended producer responsibility	An environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. ¹³⁸
Externalities	A positive or negative consequence (benefits or costs) of an action that affects someone other than the agent undertaking that action and for which the agent is neither compensated nor penalized through the markets. ¹³⁹
Flagship species	Species that, by being charismatic or famous, can attract funding which will help conservation of other species at the same time. ¹⁴⁰
Ghost gear	Discarded, lost, or abandoned, fishing gear in the marine environment. This gear continues to fish and trap animals, entangle and potentially kill marine life, smother habitat, and act as a hazard to navigation. ¹⁴¹
Gill nets	A wall of netting that hangs in the water column, typically made of monofilament or multifilament nylon. Mesh sizes are designed to allow fish to get only their head through the netting but not their body. The fish's gills then get caught in the mesh as the fish tries to back out of the net. ¹⁴²
Intrinsic value	The values of nature expressed independently of any reference to people as valuers and include entities such as habitats or species that are worth protecting as ends in and of themselves. ¹⁴³

Term	Definition
Keystone species	A species whose impact on the community or ecosystem is disproportionately large relative to its abundance. Effects can be produced by consumption (trophic interactions), competition, mutualism, dispersal, pollination, disease, or habitat modification (non-trophic interactions). ¹⁴⁴
Marine ecosystem	Ecosystems within the ocean.
(Marine) Protected areas	A clearly defined geographical space (within the ocean), recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. ¹⁴⁵
Nature	The natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment. ¹⁴⁶
Nature-based solutions	Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits. ¹⁴⁷
Nature-positive	A high-level goal and concept describing a future state of nature (e.g. biodiversity, ecosystem services and natural capital) which is greater than the current state. ¹⁴⁸
Nature-related physical risk	The risk of losses caused directly from changes in nature. ¹⁴⁹
Nature-related systemic risk	The more complex secondary risk that arises from interactions in human networks causing the breakdown of the entire system rather than the failure of individual parts. ¹⁵⁰
Nature-related transition risk	The risk arising from the anticipated continued global shift towards a more sustainable, net zero, nature-positive economy. This can be broad in nature and tend to be highly uncertain. ¹⁵¹
Net zero	Condition in which metric-weighted anthropogenic greenhouse gas (GHG) emissions are balanced by metric weighted anthropogenic GHG removals over a specified period. ¹⁵²
Non-use value	Value to humans derived from the knowledge of the existence of a species, even if they never have or will use them.
Ocean	All connected saline ocean waters characterised by waves, tides and currents. ¹⁵³
Option value	Value to humans derived from retaining the option of benefiting from species in the future.

Term	Definition
Phytoplankton	Phytoplankton are the plant forms of plankton (e.g. diatoms), and are the dominant plants in the sea. ¹⁵⁴
Primary production	The conversion of energy to organic substances by photosynthetic and chemosynthetic autotrophic organisms such as plants and phytoplankton. ¹⁵⁵
Stranded assets	Assets exposed to devaluations or conversion to 'liabilities' because of unanticipated changes in their initially expected revenues due to innovations and/or evolutions of the business context, including changes in public regulations at the domestic and international levels. ¹⁵⁶
Sustainability	A characteristic or state whereby the needs of the present and local population can be met without compromising the ability of future generations or populations in other locations to meet their needs. ¹⁵⁷
Use value	Services used directly by humans such as tourism, and services which benefit humans indirectly such as climate change mitigation
Whale fall	The sinking of whale carcasses to the ocean floor.
Whale pump	The transfer of nutrients within the water column and across latitudes by whales.
Whale watching	Defined here as watching any marine mammal from a boat or shore. ¹⁵⁸

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