ECONOMIST IMPACT

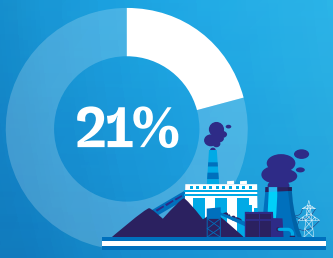
World Ocean Initiative

The oceans' silent sentinel:

how ocean observation data power marine climate change mitigation

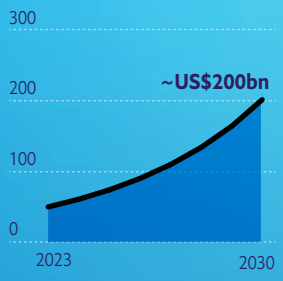
Economist Impact's World Ocean Initiative has undertaken a vital research programme to provide a high-level estimate of the global value of ocean observation data for marine-centred climate change mitigation. These findings are reflected in the infographic below.

Oceans will be critical in solving the climate crisis

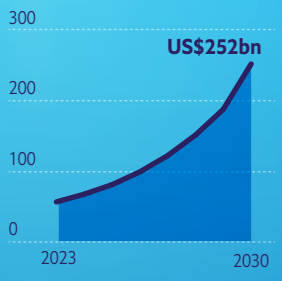


By 2050 marine-centred climate change solutions could make up 21% of the emissions reductions needed to limit global warming to 1.5°C. This equates to more than all the emissions from coal-fired power plants worldwide[1]

The global marine-centred climate change mitigation sector also promises sizable economic gains

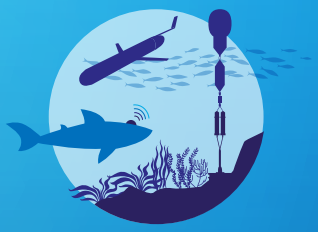


The global marine-centred climate change mitigation sector is estimated at ~US$52bn in 2023, which is projected to quadruple in size by 2030



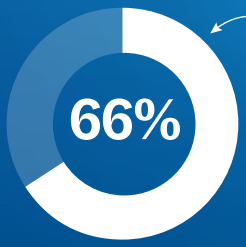
With concerted efforts from nations towards their net-zero targets, the sector has the potential to expand fivefold, reaching US$252bn by 2030

Governments, academia and private industry are investing billions of dollars in ocean observation data collection



They are capturing a diversity of information on the ocean environment, including seafloor geology, plankton population dynamics, shipping lane traffic and baseline ocean conditions[2,3,4]

Ocean observation data:[5] A hidden asset

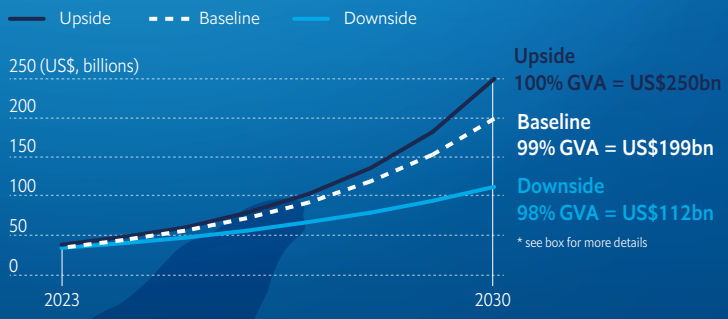


Currently, two-thirds of the US$52bn global marine-centred climate change sector is dependent on ocean observation data

Without this access, the sector could lose up to **US$34bn**

The sector is reliant on ocean observation data

As climate change mitigation activities expand, ocean observations will become an existential matter for the sector. By 2030 more than 90% of the sector's gross value-added (GVA) will rely on these data



Why is ocean observation data critical?

Ocean observation data are critical to marine-based climate change management and mitigation. The types of ocean observation data, volume of data and regularity at which these data are collected have all increased dramatically

Ocean observations are critical for understanding the pace and extent of climate change, which enables science-driven mitigation efforts

Ocean temperature detection can better predict weather patterns, which supports sustainable fishing and aquaculture activities

Seafloor measurements are necessary for developing marine energy, marine carbon dioxide removal and many blue carbon projects

Ocean observation data are essential for tracking marine ecosystems and supporting net-positive biodiversity outcomes in industries such as offshore wind, marine renewable energy, carbon dioxide removal and blue carbon initiatives

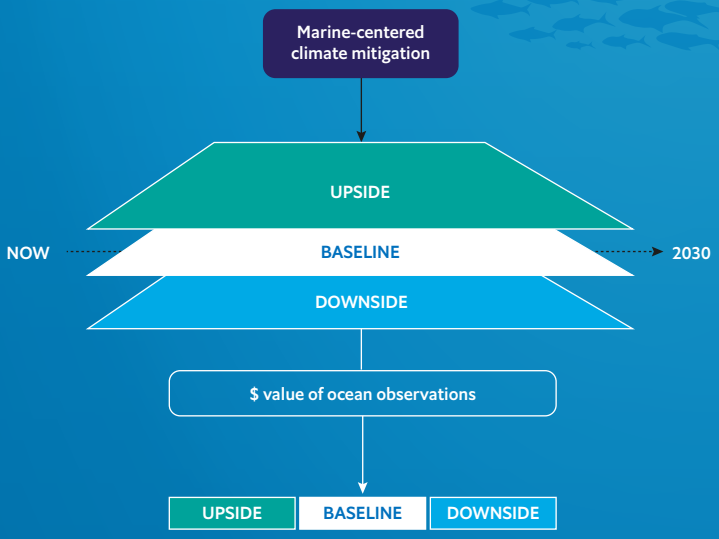
Ocean observations: a multi-billion-dollar stake in climate-change mitigation

The marine-centred climate change mitigation industries featured below have the potential to outperform the global economy[6]

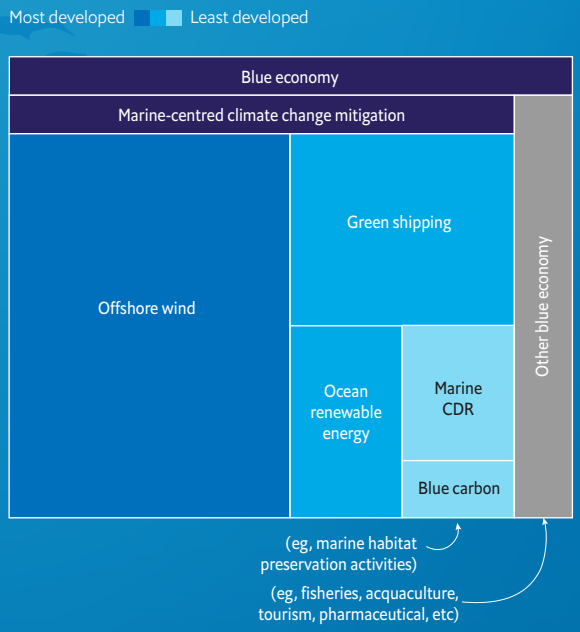
Framework for valuing ocean observation data

Core research was conducted in two parts, corresponding to the valuation framework shown below. It began with a bottom-up quantitative analysis of the global value-added of marine-centred climate change mitigation activities within ocean industries, including forecasting this value by 2030 under baseline, upside and downside scenarios.

Valuation approach



Industries in scope



The scenario estimates for each industry used the following assumptions as a basis for key drivers:

UPSIDE	Steady advances towards 2050 net-zero emissions targets and the existence of a mature global carbon market
BASELINE	Slow progress towards industry-specific net-zero targets
DOWNSIDE	Lack of action towards net-zero emission targets

Industry-specific factors also informed the development of the three scenarios; more details can be found here. In addition to the industry-specific valuation scenarios, relative growth in the value of ocean observation data over the forecast period was adjusted in the downside and upside scenarios, and applied consistently across industries.

Source: Economist Impact (2023)
For more information, please refer to the detailed appendix here

Industries in scope

OFFSHORE WIND

Ocean observation data are vital for the offshore wind industry.[7]

For example, these data help with:

- choosing locations and monitoring ecosystems
- designing resilient structures
- optimising operations based on wind and wave conditions

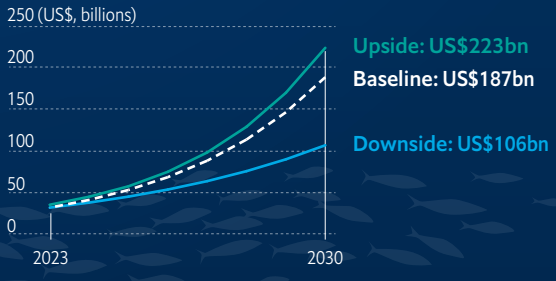
67%

of the US$48bn industry is dependent on ocean observation data in 2023

US$32bn

estimated loss without access to ocean observation data

As the industry expands, ocean observations will become the sole basis for its GVA by 2030. This is equivalent to:



GREEN SHIPPING

Ocean observations aid the decarbonization of the shipping industry by providing critical data on weather patterns, sea conditions, and vessel performance.[8,9]

For example, these data help with:

- route optimisation
- reduction of fuel consumption
- emission monitoring and reporting

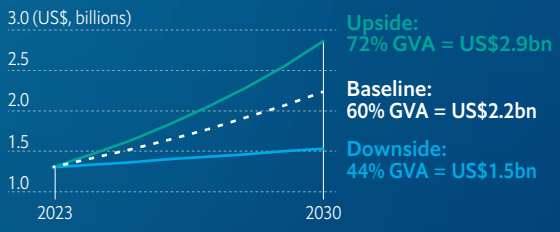
40%

of the US$3bn industry is dependent on ocean observation data in 2023

US$1.3bn

estimated loss without access to ocean observation data

As decarbonisation efforts in the shipping industry expand, more than half of the industry's economic value will depend on ocean observations. By 2030:



OCEAN RENEWABLE ENERGY

Ocean observations benefit the ocean renewable energy (wave and tidal) industry by providing critical data on wave patterns, tidal currents and ocean conditions.[10,11]

For example, these data help with:

- designing and placing energy devices (converters, turbines, etc)
- optimising energy production
- durable installations

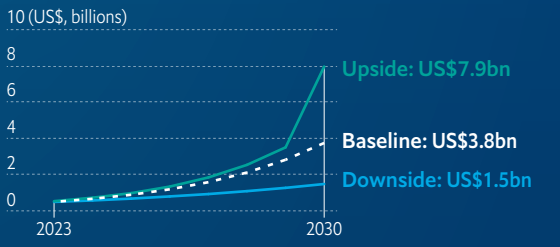
78%

of the US$666m industry is dependent on ocean observation data in 2023

US$517m

estimated loss without access to ocean observation data

As the industry expands, ocean observations will become the sole basis for its GVA by 2030. This is equivalent to:



BLUE CARBON

Ocean observations benefit the blue carbon industry by providing critical data on coastal ecosystems' health and carbon storage capacity.[12]

For example, these data help with:

- establishing marine protected areas
- monitoring ecosystems to track carbon market credits
- developing sustainable management practices and marine spatial planning

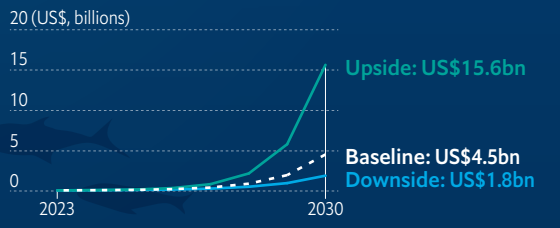
79%

of the US$18m industry is dependent on ocean observation data in 2023

US$14m

estimated without access to ocean observation data

As the industry expands, ocean observations will become the sole basis for its GVA by 2030. This is equivalent to:



MARINE CARBON DIOXIDE REMOVAL (CDR)

Ocean observations support the marine CDR industry by providing critical data on oceanic carbon dynamics.[13,14]

For example, these data help with:

- identifying suitable locations for CDR projects
- assessing the effectiveness and environmental safety of carbon removal methods
- tracking and reporting for carbon credit trade

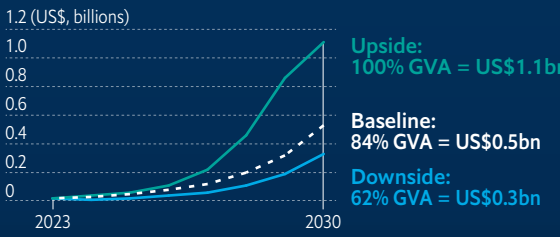
56%

of the US$40m industry is dependent on ocean observation data in 2023

US$23m

estimated loss without access to ocean observation data

As the industry expands, more than half of the industry's economic value will depend on ocean observations. By 2030:



The ocean data revolution

Despite the significant role of ocean observations in marine-based climate change mitigation efforts, the full economic potential of such data are not yet being leveraged. Only a small fraction of the data collected is actually used for productive means. Without more efficient data collection and sharing, efforts to track climate change and the impact of mitigation activities will be hindered.

Better leveraging ocean observation data, its derivative products and technologies will require co-ordinated action by all stakeholders, from the public and private sectors to academia and non-profit organisations. Strategies and actions to be considered include:

- Raising public awareness
- Fostering international collaboration
- Investing in training programmes and capacity-building initiatives
- Encouraging private sector involvement
- Developing integrated data management systems
- Improving discovery, accessibility and interoperability
- Investing in enhanced data collection

References

[1]Ocean Panel. (2023, September 28). High level panel for a Sustainable Ocean Economy. https://oceanpanel.org/

[2]Bloomberg Professional Services. (2022, March 5). Venture capital, PE invest $53.7 billion in climate tech | Insights | Bloomberg Professional Services. https://www.bloomberg.com/professional/blog/venture-capital-pe-invest-53-7-billion-in-climate-tech/#:~:text=Climate%2Dtech%20startups%20raised%20%2453.7,ion%20batteries%20to%20electric%20aviation.

[3]Public and private sectors to advance ocean observing. (2023, July 11). Intergovernmental Oceanographic Commission. https://www.ioc.unesco.org/en/articles/public-and-private-sectors-advance-ocean-observing

[4]The United States Government invests $3.9 million for Ocean Enterprise engagement. (2023, September 28). UNESCO.https://www.unesco.org/en/articles/united-states-government-invests-39-million-ocean-enterprise-engagement

[5]We define ocean observation data as the systematic collection of ocean data, which typically features three main characteristics: 1) data describe physical properties of the ocean (including the ocean-atmosphere layer and ocean chemistry); 2) data are observed on a regular basis to track changing ocean conditions—although some may be measured on a one-time basis in some locations, typically due to constraints such as ocean depth; and 3) the data have global relevance. Ocean observations are thus distinguishable from other types of ocean-related data, such as measurements of marine life or habitats, or human activities in the ocean.

[6]OECD. (2022, June 10). OECD work in support of a sustainable ocean. OECD, the Ocean. Retrieved October 25, 2023, from https://www.oecd.org/environment/2022-OECD-work-in-support-of-a-sustainable-ocean.pdf

[7]Building Ocean observing infrastructure for offshore wind energy development. (n.d.). National Oceanic and Atmospheric Administration. https://www.noaa.gov/interagency-ocean-policy/2022-sost-opportunities-and-actions-roundtable/building-ocean-observing-infrastructure-for-offshore-wind-energy-development

[8]Rayner, R., Jolly, C., & Gouldman, C. (2019). Ocean observing and the blue economy. Frontiers in Marine Science, 6. https://doi.org/10.3389/fmars.2019.00330

[9]Understanding Ocean Observing Systems And Their Impact On Ocean Analysis. (n.d.). https://www.sofarocean.com/posts/understanding-ocean-observing-systems-and-their-impact-on-ocean-analysis

[10]Copping, A., Green, R., Cavagnaro, R. J., Jenne, D., Greene, D., Martínez, J. I. J., & Yang, Y. (2020). Powering the Blue Economy - Ocean Observing Use Cases report. https://doi.org/10.2172/1700536

[11]De Lestang. ((2021, September 7). Earth observation of marine & Coastal blue carbon habitats. ArcGIS StoryMaps. https://storymaps.arcgis.com/stories/294cfc208bf849deb3a9a719560b0a6d

[12]Pham, T. D., Ha, N. T., Saintilan, N., Skidmore, A. K., Phan, D. C., Le, N. N., Viet, H. L., Takeuchi, W., & Friess, D. A. (2023). Advances in Earth observation and machine learning for quantifying blue carbon. Earth-Science Reviews, 243, 104501. https://doi.org/10.1016/j.earscirev.2023.104501

[13]How is ocean observing data used? (n.d.). https://oceanservice.noaa.gov/facts/oceanobsdata.html

[14]Boyd, P. W., Claustre, H., Legendre, L., Gattuso, J., & Traon, P. L. (2023). Operational monitoring of Open-Ocean carbon dioxide removal deployments: detection, attribution, and determination of side effects. Oceanography. https://doi.org/10.5670/oceanog.2023.s1.2

About the research

Economist Impact's World Ocean Initiative has undertaken a unique and vital research programme to estimate the economic value of ocean observation data streams to marine-centred climate-change mitigation activities globally. It demonstrates the benefits that would accrue if public, private, academic and philanthropic initiatives could more effectively unleash the potential of ocean observation data through greater data accessibility and usability, talent development, and public-private partnerships.

By taking a first step towards improving our understanding of the economic linkages that inform and drive the blue economy, we hope to bolster the case for improved and expanded ocean observations, climate-change mitigation efforts, and research on the economic value of data for the blue economy.

Please note that this research is independently conducted by Economist Impact and supported by:

- Fisheries and Oceans Canada / Peches et océans Canada
- Fugro
- National Oceanic and Atmospheric Administration
- Ocean Frontier Institute at Dalhousie University
- Syndicate 708

Disclaimer

The dollar valuations for ocean observation data to the marine-focused climate change sector are derived from a comprehensive estimation exercise. This process involved a meticulous examination of existing datasets (where available), thorough literature review, consultations with experts, and consideration of net-zero emission targets. It's important to note that these valuations are not derived from a statistical forecasting model or technique, given the emerging nature of the industries under study and limited data availability. For more information, please refer to the detailed appendix, here.