Neptune Mission Scientific Goals

The health of the ocean - the most important life supporting system on our planet - is measurably in decline due to the climate disruption and multiple anthropogenic stresses. Both the protection of the ocean and its sustainable use require robust governance and sufficient knowledge.

The modern ocean governance - a global system conventions and protocols - including the fundamental UN Convention on the Law of the Sea (UNCLOS) of 1982, has recently made a major step forward: the High-Seas Treaty (BBNJ) under the UNCLOS is entering in force on 17 January 2026. For the first time in history, BBNJ sets legally binding rules for human activities in management of marine genetic resources, including the fair and equitable sharing of benefits stemming from them; in environmental impact assessments; in area-based management tools, including Marine Protected Areas (MPAs); and in capacity sharing, building, and the transfer of marine technology.

To maximize the benefit from the new ocean legislation, it is essential to know what needs to be protected and restored, and it is equally important to know how this can be done efficiently. Our knowledge is, unfortunately, insufficient because the ocean remains the least known biome on planet Earth.

The “Neptune Mission” will be the major international scientific program poised to make a breakthrough in several areas where the impact of new knowledge will be most important for solidifying modern ocean governance. For that purpose, the Neptune Mission will bring together the talents and resources of the ocean organizations of goodwill. It will be acting in line with recommendations 1, 3 - 7 of the 2025 Future Science Brief by the European Marine Board[1] and its statement that “the deep sea encompasses 90% of total ocean volume, hosts diverse ecosystems with potentially millions of (mostly unknown) species, and provides essential ecosystem services and functions”. The Neptune Mission’s planning echoes with the two major objectives of the Challenger 150 seminal paper[2], which asks “What is the diversity of life in the deep ocean?” “How are populations and habitats connected?”[3] The Mission will focus its energy on **exploring the most unknown ecosystem of our planet and launch expeditions to uncover new oceanic biodiversity**.

The Neptune Mission will proceed forward with the full understanding of the shifting geopolitical balances in the ocean and the emergence of the mighty global blue economy. Recognizing these political and market forces and their major influence on the fate of the ocean, the Neptune Mission will also aim to reinforce ocean conservation through creating deeper emotional connections between humankind and the ocean. This will be achieved by facilitating ocean literacy, based on relevant and interesting scientific facts, and, especially, by capitalizing on curiosity about the deep ocean and mysterious life in it. This work will be ultimately building human empathy and supporting more ethical and harmonious relations between people and the ocean.

[1] Future Science Brief, No 12 April 2025, Deep Sea, Research and Management Needs, European Marine Board

[2] A Blueprint for an Inclusive, Global Deep-Sea Ocean Decade Field Program. Front. Mar. Sci. 7:584861. doi: 10.3389/fmars.2020.584861

[3] The following definition of “deep sea” applies: the column from the sea surface to the bottom in areas with depth of more than 200 meters. The Neptune main interest will be on Areas Beyond National Jurisdiction (ABNJ).

At the heart of the Neptune Mission's ambition will be the **holistic forward-looking vision** of the deep sea encompassing its environmental, social, cultural, legal, and economic dimensions along with anticipation of how high-seas ecosystems will evolve in the context of climate change and other threats. Such an integrated approach is vital for supporting **policies** for ocean protection, for example, for managing fish stocks and other resources more sustainably, and for regulating resource access more fairly.

Key science challenges of Neptune Mission

Building on previous discussions, the following preliminary challenges are proposed for consideration by the Neptune Mission community. The objective is to collectively review these challenges, identify societally and scientifically meaningful goals within these areas (and, where relevant, in additional domains of interest), and align them with the technological capabilities and strategic interests of Neptune Mission partners.

To date, eight interrelated challenges have been identified. These challenges are not independent; rather, they interact and reinforce one another. Instead of being treated as separate topics, they should be viewed as the interconnected foundations of a shared framework, much like the structure of a common house or the roots of a wisdom tree.

Challenge 1: Habitat mapping to better understand ocean ecosystems and contribute to achieving the 30×30 conservation target

Habitat mapping in the ocean remains a challenge at a significant scale, from the seabed across midwater to the surface. As is known, “visual imaging is one of the most critical methods for studying the deep seafloor”[4], yet the number of images is limited given the vastness of the ocean. Direct visual contact with deep sea life has been shown to be an extremely effective way of raising public awareness. Ocean habitat maps have been created on a large-scale using satellite data to obtain bathymetry, ice cover or surface temperature at coarse resolution of the order of kilometres. Numerical models can be used to extrapolate data to greater depths and for the near future. This Neptune Mission challenge will elaborate ways to effectively identify biodiversity patterns and related ecosystem dynamics, overcoming the limited resolution of existing large-scale maps. Especially in the domains of habitat conservation, recovery and restoration, mapping is required at the scale of ecosystem components. Furthermore, we will use the mission to prepare the next generation of digital twins of the ocean (DTOs) that incorporate marine biodiversity more comprehensively. For these reasons, the Neptune Mission will be closely coordinated with the Space4Ocean and Mercator IGO initiatives promoted during the third UN Ocean Conference (UNOC3).

Ocean habitat mapping could make a decisive contribution to achieving a further major step forward in the General Bathymetric Chart of the Oceans (GEBCO) coverage and initiating habitat and ecosystem mapping of areas warranting specific attention (prospective MPAs, seamounts, ‘empty’ areas with little data, fronts, ridges and fractures, and areas where the risk of seabed mining is the highest – supporting Ocean Pioneers group of nations, etc.).

[4] Bell et al., Sci. Adv. 11, eadp8602 (2025)

Challenge 2: Exploring and safeguarding key areas of ocean abundance

A dedicated focus will be placed on regions of 'Ocean Abundance' — areas where marine life remains as rich and dynamic as in pre-anthropogenic times.

These regions include the major upwelling systems and extensive continental margins off Africa and the Americas, as well as the polar fronts where great whales feed and where some of the strongest carbon fluxes on the planet occur. These areas support exceptional concentrations of biodiversity and productivity, with upwelling systems acting as the ocean's primary carbon pumps for transfer between the atmosphere, surface ocean, and the deep ocean. Incorporating these hotspots of abundance into the Neptune Mission's priorities is essential for anticipating future trajectories of ocean biodiversity, carbon cycling, and planetary resilience. Achieving this requires accurately characterizing the physical, chemical, and biological forces that shape these ecosystems, as well as documenting the direction, pace, and magnitude of the changes they are undergoing.

These hotspots are not only scientific frontiers; they are also decision frontiers - places where the future of the ocean, and the choices our societies make in response, will be defined.

Challenge 3: Deciphering the biodiversity dynamics of seamounts, major hotspots of oceanic life, to inform their conservation and sustainable management

Seamounts are biodiversity hotspots for seafloor (benthic) and water column (pelagic) organisms. They are springboards for species dispersal. Seamounts are home to unique communities, particularly deep water coral gardens and sponge fields, and provide a valuable habitat for many marine species. The geology of the seafloor influences the conditions under which benthic and pelagic populations develop. The interaction of ocean currents with these submarine topographies generates strong currents, eddies, variations of water temperature and salinity, and internal ocean waves that mix and transport waters with characteristics (temperature, salinity, oxygen, carbon, nutrient concentration, etc.) that differ from waters at distance from the seamounts. Gradients of water properties trigger biological productivity that attracts pelagic fish and marine mammals and also play a major role in physical mixing of the ocean.

Despite increasing research efforts, very few seamounts have been explored. Little is known about their structure and function in deep-sea ecosystem dynamics. Their often-remote location in the middle of the ocean, the difficulty of sampling their biology, the high variability of environmental conditions, and the lack of interdisciplinary and integrated studies are among the reasons for this lack of knowledge.

Seamounts raise questions of particular scientific interest such as:

- What is the role of the hydrographic disturbances in controlling biodiversity?
- Why do some seamounts have many endemic species while others have none?
- What can we learn about them from indigenous knowledge such as that of Melanesian and Polynesian communities?

Challenge 4: Polar oceans as emblems of particularly sensitive areas

Polar oceans are vast and rapidly transforming regions essential to global ocean circulation, carbon cycling, and climate stability. Adjacent island systems that are also affected by these changes can serve as frontline observatories of change. These realms contain a unique diversity of life and support an exceptional abundance of marine mammals and seabirds.

In such remote and extreme environments, research efforts should be closely coupled with next-generation ocean technologies and infrastructures. Autonomous robotics, low-carbon research platforms, and sustained observing systems are essential to enable continuous exploration and long-term monitoring.

Polar regions are facing environmental challenges that are indicative of global planetary disruption. The impacts of global warming are particularly rapid and pronounced, compounded by additional pressures such as expanding resource exploitation, the opening of new shipping routes, accelerating ice melt, and ongoing biodiversity loss. These transformations have far-reaching consequences: first for indigenous populations whose livelihoods and cultures are directly affected, and second for the global community, given the poles' influence on Earth system processes.

As early indicators of the planet's climatic, oceanic, and biological disequilibrium, the polar regions are of critical importance for international research and cooperation. Their strategic significance, heightened by the convergence of climate and geopolitical pressures, underscores the urgency of developing robust science-to-policy initiatives in these regions.

Challenge 5: Unlocking the potential of deep-sea vents as sources of bioinspiration and understanding the role of biology in marine resources

Hydrothermal vents and cold seeps are biodiversity oases. New vents in the deep biosphere are discovered each year. The contribution of these vents to ocean geochemistry is an active area of research because they appear to be effective producers of particulate carbon, and because chemical transfer from the lithosphere to the ocean aided by microorganisms is poorly understood on a global scale. The unknown volume of carbon dioxide, methane and hydrogen released by these vents and seeps is a question of great importance for the oceanic biodiversity. These areas support unique ecosystems where microorganisms use geochemical reactions as an energy source, playing a key role in controlling the amount of these gases that reaches the atmosphere and concentrating metals, trace elements and other components from the lithosphere to the seafloor. Moreover, the exchange between solid earth, biosphere, and water column demonstrates the role of the deep ocean in the liveability of the planet.

Polymetallic manganese nodules are another geochemical resource controlled by the action of microorganisms. Understanding their role more completely is essential as the mining of manganese nodules is debated and requires science-to-policy initiatives.

Challenge 6: Safeguarding the ocean's role as a global carbon sink – ensuring stability and resilience of marine carbon cycle

As the ocean changes quickly under multiple stresses, one process directly links the productivity and diversity of marine organisms to the global carbon cycle. This process is known as the biological ‘carbon pump’ through which intricate biological processes facilitate the transfer of carbon from the atmosphere to the ocean floor.

While the general characteristics of the pump are known, several critical aspects remain poorly understood:

- Spatial and temporal dynamics: the distribution of key organisms, from viruses to whales, and their signature metabolites, as well as their abundance across time and space;
- Influencing factors: the conditions that govern this distribution, i.e. biological productivity and breakdown, nutrient cycling, eutrophication, oxygen supply, ocean acidification, pollution and consequences for food webs;
- Specific mechanisms controlling the export of organic matter from the surface to the depths;
- Recycling and sequestration: the processes and organisms involved in the recycling of organic matter or its permanent sequestration;
- Human impact: the effect of high-seas anthropogenic stressors, including fishing, on the carbon pump; and,
- Role of MPAs: the potential role of no-take zones and high-seas MPAs in influencing the carbon pump.

Our limited understanding of these processes presents a significant challenge in accurately modeling and predicting the ocean's productivity and its impact on the global carbon cycle. It leads to major uncertainties in understanding of our planet's response to climate change.

Challenge 7: Revealing Anthropocene biodiversity trajectories through paleogenomic analysis of marine sediments

Paleogenomics has made significant progress in recent times, recognized by a Nobel Prize in 2022. Applying paleogenomics to sub-seafloor sediment cores will allow Neptune Mission to reconstruct pre-human ecosystem baselines and understand how organisms respond to environmental changes, including anthropogenic pressures.

Neptune Mission will promote research on deep-sea marine sediments, as they hold records of the past ocean - its climatologies and ecosystems. We have hundreds of kilometres of sediment cores already available in collections at marine laboratories and from the deep ocean drilling programs. Developing methods to use them for exploring the past ocean could be a game changer. To do so, we need to develop more and better paleoproxies and develop paleogenomics tools for deep-sea application.

Challenge 8: Advancing sustainable and ethical approaches to Marine Genetic Resource (MGR) exploration aligned with international frameworks

At its core, understanding of the ocean's functioning hinges on profound knowledge of both its living components and their biotic and abiotic environment. To truly grasp how the ocean operates, Neptune Mission must incorporate a dedicated focus on marine resources, including genetic resources in the high seas.

Here are the key objectives for this component:

- Mapping deep-sea biodiversity and understanding its functional role.

  Employing cutting-edge approaches, such as metagenomics and metabolite approaches or AI-based image analyses, we will comprehensively map the diversity and network of life in the deep ocean and its associated habitats. This set of activities is not just about cataloguing; it will allow Neptune Mission to uncover the full spectrum of marine life, its interactions, its associated services and resources, as well as the legacy of 4 billion years of evolution of life in the ocean.

- Understanding and enabling ecosystem resilience and recovery through an integrative approach

Using a portfolio of novel genomics tools, observational, experimental and modelling approaches we can comprehend how species adapt to and how ecosystems recover from disturbances. This knowledge is vital for predicting how marine environments will withstand and respond to climate change, but also to inform MPAs and restoration efforts.

- Fostering innovation and equitable access

By developing innovative biotechnologies and establishing sustainable, FAIR-compliant, and open databases we will build shared knowledge and facilitate responsible bioprospecting. This ensures that the benefits derived from these discoveries are shared equitably, fostering a collaborative and sustainable approach to marine research.

By actively pursuing these objectives, Neptune Mission will not only enhance our fundamental understanding of the ocean's biological "power engine" but also pave the way for sustainable resource management and equitable sharing of invaluable marine genetic resources, ultimately bolstering our ability to address the challenge of climate change.

Expected Mission Outcomes

Public engagement – a top priority

At the One Ocean Science Congress in June 2025, scientists highlighted that the ocean stands at a defining moment. In a shared Manifesto, they affirmed that the ocean, essential to planetary health, is under increasing threat from warming, acidification, pollution, and overfishing, noting that “the ocean’s life-supporting functions are being steadily eroded.” Against this backdrop, public engagement emerges as a central and expected outcome of the Neptune Mission.

To achieve this goal, the Neptune Mission will mobilize the scientific knowledge generated through exploration to create compelling forms of engagement. These will include storytelling, artistic and literary expressions, immersive media, and digital experiences that help shape collective imaginaries and deepen our relationship with the largely unknown abyss. This capacity to connect exploration, imagination, and understanding lies at the heart of Neptune’s transformative ambition. The Neptune Mission recognizes that lasting ocean abundance can only be achieved if exploration and science are shared, understood, and collectively embraced. Public engagement is therefore not ancillary but foundational to the mission. By drawing on expedition data, imagery, soundscapes, digital twins, and the ocean nexus that links ocean processes to daily life, the mission will connect citizens, students, decision-makers, and cultural audiences to the deep ocean, the high seas, and the living systems that sustain life on Earth.

A shared ocean vision

By meeting our scientific challenges and our public engagement goals, Neptune Mission should achieve the following major societal outcomes:

- A stronger knowledge-based foundation of ocean governance;

- A stronger scientific basis for ocean-related investment domains;
- More ocean-literate, hence more ethical society.

The results will support the BBNJ agreement and its four main goals as well as previous ocean-related environmental conventions and protocols promoting a healthy ocean. The results will be synthesized into essential biological and ecological variables. These variables can be existing essential ocean variables (EOV) or new ones created from Neptune Mission discoveries. EOV together with mapping habitats are critical for monitoring marine ecosystems and should serve as the basis for proposing effective MPAs. There is no doubt that the acquired knowledge will inform the strategies for nature restoration. Furthermore, it will provide the necessary data to propose the next generation of ocean DTOs that will include oceanic biodiversity.

Among the cross-cutting priorities, an emphasis will also be placed on the Ocean–Space nexus, promoting the integration of space-based data and the development of digital twin systems—such as Mercator—to enhance observation, modeling, and decision-support capacities. This approach will strengthen cooperation between the space and ocean science communities, ensuring that technological innovation and global monitoring converge in service of a unified and resilient Ocean governance.

Overall, we are convinced that the Neptune Mission will craft a 21st century scientific ocean vision that will embrace advanced knowledge of dynamics, biogeochemistry and biology, and ocean interactions with the rest of the Earth system in the geological epoch of Anthropocene.

Cross-cutting enablers

The Neptune Mission is supported by a set of cross-cutting enablers that together form the essential backbone for addressing the Mission’s major scientific challenges and delivering its targeted outcomes. Beyond their enabling role, these elements also contribute directly to public engagement. Through maps, advanced technologies, numerical avatars, geopolitical perspectives, and opportunities for adventure and exploration, particularly for younger generations, they have the power to stimulate imagination, curiosity, and a deeper connection to the ocean

Enabler 1: Defining Neptune Exploration Priority Areas

The ocean is vast. Nevertheless, cooperative programs, such as Seabed 2030, have succeeded in expanding the high-resolution bathymetric map from 5% to 27% of the total ocean area with a major effort as part of the UN Decade of Ocean Science for Sustainable Development. This is a significant advance in our quantitative understanding of the ocean. However, this shows that given the current state of technology and available data, only a small portion of the ocean habitat and ecosystems can be comprehensively mapped and described quantitatively. This suggests that in order to have Neptune Mission make a strong contribution to ocean conservation, of major significance to BBNJ goals, we must prioritize its areas of investigation. Agreeing on an initial priority areas, termed the “Neptune Exploration Priority Area” (NEPA), can therefore be a high-level, visible focus for the global audience. It can facilitate global interest and promote collaboration with many existing international initiatives. The initial ideas for NEPA could include, for example, BBNJ areas of initial interest, 30x30 plans, Ecologically or Biologically Significant Areas (EBSAs), or International Seabed Authority (ISA) exploration contract areas.

Developing a NEPA exploration plan will unite partners. Combining bathymetric and ocean life mapping and expanding the knowledge about ecosystems functioning in areas of critical importance is a logical progression from the currently siloed process orientation to a more holistic view of the ocean. Neptune Mission could start as early as in 2026, supporting existing global dataset providers such as Seabed 2030, OBON, OBIS and Challenger 150, and leading to creation of maps and further discussion of exploration priorities with all potential partners. The Mercator Ocean International must be involved from the start to provide the fourth dimension of this initial mapping effort. During the mission implementation, the output of this process will be a constantly improving 4-D Digital Twin of the NEPA(s). The NEPA(s) could become the first deliverable of Neptune Mission to the ocean explorer community. It can be presented to the first BBNJ Ocean COP (COP1 Ocean) and enable this Conference to agree on its first major tangible outcome.

Enabler 2: Technology to open doors to the deep unknowns

The overall Neptune Mission framework is contingent on a robust and sustained observation system of the ocean. Understanding ecosystem and carbon cycle changes (current and future) demands an unprecedented observational effort. While technologies exist, they require significant consolidation, sharing and development. The examples below show great potential for transformative and innovative ways to observe, model, and project the ocean change:

- Advanced sensors: e.g., nanotechnology-based sensors, *in situ* genomic samplers and sequencers;
- Autonomous platforms: underwater drones, AUVs, profilers, gliders, floats;
- Ships-of-opportunity: (i.e. sailing boats, cruise ships) to operate equipment, including sensors, samplers, mappers, cameras, ROVs;
- Stationary long-term monitoring platforms: both existing long-term monitoring stations and/or moorings and new platforms
- Satellite technology including nanosatellites;
- Fleets of aerial drones; and
- Existing and new environmental molecular biology and genomic tools.

In close collaboration with the Ocean Biomolecular Observing Network (OBON), the Neptune Mission will include the use of scalable molecular methods, incorporating eDNA and other metagenomics, as well as emerging biomolecular tools combined with the latest developments in imaging and micro-imaging tools including AI-based species identification, to discover and catalogue marine biodiversity and genetic resources. This method must be disseminated rapidly to speed up biodiversity description. Ground truthing of biodiversity through sampling of taxa and taxonomic description is needed to expand and improve reference libraries. They have to be complemented with a wide range of other ecological studies focusing on functional diversity and food web dynamics and evolution.

These developments are also needed to identify existing and potentially new essential biological and ecological variables critical for monitoring marine ecosystems and to ensure effective conservation strategies. These ecosystem insights will then be translated into support for the BBNJ Agreement, marine spatial planning, design of MPAs, and broader sustainable development strategies. This will be a major outcome of the Neptune Mission.

Showcasing and funding technological developments should also form part of the amazing Neptune's story, connecting this initiative to pioneering exploration missions. Furthermore, technological innovations will facilitate deployment of new technologies, data and knowledge sharing and capacity development, greatly accelerating biodiversity discovery.

Enabler 3: Development and use of next-generation models to support science-based ocean governance and decision-making

Developing advanced models of the ocean is paramount for assessing different scenarios of ocean future and improving predictive skill through integrating the vast array of past and future observations, synthesizing complex knowledge, and enabling informed public decision-making based on plausible scenarios. Sophisticated virtual replicas, such as DTOs, are revolutionizing our ability to understand marine environments and predict impacts of various changes and actions. The objectives of the Neptune Mission's model development work will include:

- Exposing combined continuous real-time and historical observations to cutting-edge artificial intelligence, machine learning, and high-performance computing for generating a consistent, high-resolution, multi-dimensional, and near-real-time virtual description of the ocean, encompassing its physical, chemical, biological, geological and crucial socio-economic dimensions;
- Simulation of a broad range of "what if" scenarios, from the effects of climate change, pollution and overfishing to the efficacy of MPAs or geo-engineering interventions;
- Empowering scientists, policymakers, industries, and citizens to explore potential future scenarios, carry out risk assessments, and make science-informed decisions for a more resilient and sustainably managed ocean; and
- Helping to predict the impacts of climate change and human activities on ocean life and assess the effectiveness of mitigation, adaptation and conservation efforts.

Achieving this quantum leap in our ability to simulate the ocean through DTOs will necessitate a concerted transdisciplinary effort. Expertise from multiple and diverse fields will have to be combined to identify most suitable models and data processing algorithms and start usefully exploiting these powerful numerical tools for societal benefit. The Neptune Mission shall help to gather new data and understanding to develop and broaden the scope of DTOs to embrace biology and ecology. It will make the DTOs relevant for managing marine genetic resources, using them in area-based management tools and environmental assessments (including impact assessments). Such models and the distribution of the foundational data are key enablers to achieve the Neptune Mission promise.

Enabler 4: Integrating natural and social sciences with a socio-ecological systems approach and policy

At the midterm of the Ocean Decade, we already need to think how to conclude it successfully and build on its emerging legacy. The related objective of the Neptune Mission is to achieve major progress in increasing the. ocean biodiversity knowledge in the next fifteen years and to stimulate cooperation between ocean explorers and decision makers for the benefit of humankind.

Integrating natural and social sciences with a social-ecological systems approach is crucial for studying the ocean, understanding future changes, and predicting potential societal drivers and impacts on society. Indeed, human activity profoundly alters the ocean, both indirectly (e.g., through temperature-driven efficiency changes) and directly (e.g., via increased atmospheric CO_2 from anthropogenic emissions, or fishing, or even potential geo-engineering). This disruption alters the ocean ecosystem and the planetary carbon cycle, ultimately creating a feedback loop on the greenhouse effect. To usefully model and predict climate change and its impacts, it is therefore essential to consider the interplay between natural systems and human activities.

Enabler 5: Neptune Fellows and early career ocean professionals (ECOPS)

Our Neptune Fellows Program is designed as a crucial enabler of the Neptune Mission. It will cultivate a global network of early-career ocean professionals, integrate scientific research with policy and foster collaboration across institutions and countries from all over the world—particularly from the Global South and Small Island Developing States. The program builds on the recognition that ocean exploration and conservation require a highly skilled, well-connected generation of scientists capable of producing actionable knowledge for international governance frameworks such as the BBNJ Treaty.

Neptune Fellows will not be observers or researchers only, but contributors to creating effective policy: co-producing knowledge, advancing open data, shaping science-policy interfaces, and gaining hands-on experience across the full water column and the entire decision chain. By coupling interest with responsibility, and exploration with stewardship, Neptune Mission will help forge a new generation capable of translating ocean knowledge into collective action.

The Neptune Fellows Program will combine scientific excellence, interdisciplinary collaboration and policy engagement in a structured two-year fellowship cycle, bridging the gap between ocean science and governance. It seeks to:

- develop world-class ocean leaders by equipping early-career researchers and practitioners with the scientific, technical, and policy skills necessary to tackle critical ocean challenges;
- foster a global community by building a collaborative network of Fellows and alumni capable of sharing expertise, mentoring peers, and contributing to international ocean policy;
- bridge science and policy by ensuring that Fellows' experience both rigorous research and policy- oriented work to translate scientific findings into actionable governance solutions; and
- support Neptune Mission priorities by aligning the Fellows' projects with the seven scientific challenges of Mission Neptune ensuring that the program contributes to high-impact ocean exploration and conservation outcomes.

Particular attention will be paid to take advantage of this program to foster collaboration between countries having a long history of scientific exploration of the ocean and new players in the field.

Final word

In sum, the Neptune Mission is conceived as more than a scientific initiative: it is an invitation to reimagine humanity's relationship with the deep ocean at a pivotal moment in Earth's history. By uniting discovery, technology governance-relevant knowledge and a new cohort of ocean leaders with public imagination, the Mission will help transform the unknown into shared understanding, and shared understanding into collective responsibility. In doing so, Neptune Mission seeks to ensure that the deep sea—long hidden from view but central to planetary health—becomes visible, valued, and wisely stewarded through informed decision-making, for the benefit of present and future generations.