Research Fund

Supporting *Science*, Acting for a Sustainable *Ocean*

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Preserving the *ocean* now and in the future

EDITORIAL BY JULIA D'ASTORG

HEAD OF THE AXA RESEARCH FUND

The ocean, often called Earth's *blue lung*, is a cornerstone of life on our planet. It generates over half of the world's oxygen and serves as a vital buffer against the impacts of climate change. Beyond its environmental significance, the ocean underpins the blue economy – a diverse and dynamic sector that includes fisheries, maritime transport, renewable energy, and tourism.
These industries sustain the livelihoods of millions around the world and play a fundamental role in ensuring global food security and driving economic growth.

At AXA, we recognize the vital role science plays in protecting the ocean and its ecosystems. Ocean risk, biodiversity loss, and climate change are interconnected challenges that demand urgent, evidence-based solutions. Yet, these areas of research often remain underestimated and underfunded, leaving critical gaps in our ability to address the threats facing our oceans. This is why we remain committed to championing the work of the scientific community.

Through targeted funding, we strive to empower independent research that drives innovation, creates awareness and informs actionable policies. By supporting pioneering projects, we aim to address current and future challenges through science.

With the right support today, science will support our tomorrow.

Ocean currents: How the *AXA Research Fund* supports science

AUSTRALIA
DENMARK
FINLAND
FRANCE
GERMANY
IRELAND
ITALY
MEXICO
NETHERLANDS
SINGAPORE
SOUTH AFRICA
SPAIN
SWEDEN
SWITZERLAND
UNITED KINGDOM
UNITED STATES

43 projects

16 countries
38 institutions

Over €9.5M

to support independent research on various issues such as marine biodiversity, impact of climate change, coastal living, fisheries and aquaculture, and blue carbon.

GOING DEEP: A TIMELINE OF OUR MAJOR ENGAGEMENTS

From marine biodiversity to coastal livelihoods resilience, here are recent examples of our commitment to ocean research.

2025
— AXA is part of the United Nations Ocean Conference (UNOC) summit in Nice, France, which aims to accelerate action and mobilize all actors to conserve and sustainably use the ocean.

2024
— Dr. Nils Goseberg wins the AXA IM Research Award supported by the AXA Research Fund for his work on nature-based solutions to protect natural coastlines from severe weather events and rising sea levels induced by global warming.

— Together with 26 foundations, AXA Research Fund signed in 2024 the Rio Action Statement roadmap for philanthropy to drive resource mobilization, outreach, advocacy, and partnerships in support of Ocean Decade initiatives ahead of the 2025 UN Ocean Conference.

2023
— The AXA Research Fund signs the UNESCO Monaco Statement, a joint statement to amplify the role of the philanthropic community in global ocean action.

2022
— AXA dedicates €1M to innovative research in the area of coastal livelihood preservation and resilience via a joint postdoctoral fellowship with UNESCO as part of the IOC Ocean Decade program.

— Dr. Ana Queiros, from the Plymouth Marine Laboratory, receives the AXA IM Research Award granted in partnership with the AXA Research Fund for her work on the development of blue carbon as a nature-based solution in climate mitigation.

2020
— AXA grants €1M to a new AXA Chair "Building Coastal Resilience with Nature Based Solutions" held by Prof Mike Beck at the University of California, Santa Cruz. The chair aims at building resilience to coastal hazards with natural defense such as coral reefs, mangroves and marshes.

2019
— AXA supports eight postdoctoral research projects following a call for proposals on marine biodiversity and its ecosystem services.

Coast to coast: 4 urgent reasons to support ocean-related research

- **To promote ocean health and resilience:** Supporting ocean-related projects helps to improve the overall health and resilience of the ocean, which in turn benefits both marine life and human societies that depend on the ocean for food, livelihoods and recreation. Funding ocean research projects helps design science-based protection measures and direct investments for environmental and societal benefits.
- **To preserve marine biodiversity:** Funding ocean-related projects can help protect and conserve the diverse range of marine species and ecosystems, contributing to overall health and balance of the ocean environment, planetary health and the economy.
- **To mitigate the impacts of climate change:** Supporting ocean-related research can assist in addressing climate change by supporting initiatives such as coastal protection, carbon sequestration and the development of renewable energy sources.
- **To support sustainable fishing practices:** Funding research projects related to sustainable fishing, helps to promote responsible and environmentally friendly fishing practices, ensuring the long-term health of marine resources and the livelihoods of fishing communities.

DISCOVER ALL INITIATIVES

"Oceans are our planet's safety net – from providing the original home for life to taking up *more than 90% of the excess heat in the climate system.* Their future determines our future. Never has there been a more urgent need to support independent and *innovative science that allows us to better protect* and understand the oceans that sustain us."

DEBRA ROBERTS

PRESIDENT OF THE AXA RESEARCH FUND SCIENTIFIC BOARD

Targeted funding for *Ocean Science* research

Over 40% of the world's population live in coastal areas increasingly exposed to climate risks, and three billion people rely on the ocean for their livelihoods. While urgent innovative adaptation solutions are needed to face the challenges to people and the ecosystems in these areas, barely 2% of scientific research funding is allocated by national states to ocean-related research, which is instrumental in the design of adequate preservation actions.

In response to a joint UNESCO-Ocean Decade Call for Actions, the AXA Research Fund has dedicated €1M to fund seven postdoctoral research projects on Coastal Livelihoods in 2022. These pioneering initiatives span diverse geographies and disciplines, advancing innovative solutions to safeguard coastal communities and ecosystems. From enhancing resilience to climate change and supporting sustainable fisheries, to empowering local stakeholders and informing global policy, the work of our grantees exemplifies a commitment to science-driven impact for the future of our oceans.

Discover their wide-ranging impact on the following pages.

ANDREA FICCHI
POLITECNICO DI MILANO, ITALY

Strengthening coastal *communities' resilience through better forecasting* and projecting compound flood risk.

Between March 4 and 15, 2019, tropical cyclone Idai hit Mozambique twice. This storm, of rare intensity, was one of the worst disasters to hit the southern hemisphere. Torrential rainfall resulted in devastating riverine and flash floods, that combined with coastal flooding due to storm surge, led to an unprecedented crisis requiring international and humanitarian assistance. Within Mozambique, 602 people lost their lives, and hundreds of thousands were left with no recourse but to be displaced, internally or to neighboring countries.

This event was catastrophic, and unfortunately it is not an isolated occurrence. Coastal areas are often at risk of compound flooding – flood events due to two or more drivers, such as storm surge, high tides, rainfall and river flows. Mozambique is at high risk of compound floods due to tropical cyclones, making it one of the world's most disaster-prone countries. Better flood forecasting and improved warnings could limit the loss of life and damage. Supported by an AXA-UNESCO fellowship, Dr Andrea Ficchì, a hydrologist, and environmental engineer based at Politecnico di Milano, has been working on PRINTFLOODS, a project aimed at improving models predicting compound flood risk and identifying high-risk areas. Drawing from interviews with local stakeholders (including humanitarians, disaster managers and forecasters), local ground observations and satellite data, he has been working to refine existing models and datasets to better support humanitarian action and increase the resilience of communities in coastal areas of Mozambique. Together with his team, Dr Ficchì has been assessing the accuracy of state-of-the-art tropical cyclone rainfall forecasts and flood prediction models. His work has led to adjusting the models' scores to better tailor them to decision-making for humanitarian action and emergency response. To improve predictions, the team, working in collaboration with the EU-H2020 CLINT Project consortium, also developed a deep learning framework that can enhance flood hazard datasets like tropical cyclone rainfall and flood maps to increase their resolution, correct spatial errors, and adjust for any potential bias in the data. Their analysis of AI-enhanced forecasts was tailored to the needs of the Mozambique Red Cross and has proven its potential, as the team were able to demonstrate the increased effectiveness for early actions, in terms of cost reductions and loss mitigation. They also worked on other case studies, building an AI model for rapid storm surge and sea-level projections to inform coastal adaptation planning, focusing on the New York City coastline, a metropolitan area highly exposed to coastal flood risk due to sea level rise and storm surge.

In October 2024, to ensure knowledge sharing and foster collaboration, Dr Ficchi also organized and led a 4-day workshop and training at the Universidade Eduardo Mondlane (UEM) in Maputo, in collaboration with Dr Ascenso from the CLINT team. The workshop brought together 25 participants from UEM and local organisations (national hydro-meteorological agencies, the Mozambique Red Cross and World Food Programme) to help strengthen existing technical capacities for climate services using AI tools. This event laid the foundation for further collaborations between Politecnico di Milano (POLIMI), UEM, national institutes, and humanitarian organisations in Mozambique. The approaches developed in the PRINTFLOODS project are designed to be transferable across geographies. The tropical cyclone rainfall and flood forecast data used are globally available, while the AI techniques tested in Mozambique can be deployed in other flood-prone regions. For the flood forecast enhancement techniques, the transfer to other regions would require some AI model tuning efforts using any available local flood data or satellite images. Humanitarian organisations and hydro-meteorological agencies in Mozambique have expressed great interest in the AI-based forecast enhancement tools developed in PRINTFLOODS, to support their anticipatory action planning, improve disaster preparedness, and allocate resources more effectively. The insights and tools first shared during the workshop in October 2024 are still being discussed within local organizations in Mozambique and online meetings with POLIMI are being held to support the transfer from research to operation, so that local communities will benefit directly from faster and more effective actions when flooding is forecast.

"A DEEP LEARNING FRAMEWORK CAN ENHANCE FLOOD HAZARD DATASETS LIKE TROPICAL CYCLONE RAINFALL AND FLOOD MAPS TO INCREASE THEIR RESOLUTION, CORRECT SPATIAL ERRORS, AND ADJUST FOR ANY POTENTIAL BIAS IN THE DATA."

FIND OUT MORE

EMMANUEL KAKUNDE MBARU
LANCASTER UNIVERSITY,
UNITED KINGDOM

Transboundary governance *for climate change adaptation* in marine socio-ecological systems.

Oceans – the largest carbon sinks on the planet – are under increasing pressure from the climate crisis. Growing evidence suggests climate change will keep disrupting marine ecosystems and knock down fisheries' revenues, affecting the communities that rely on them.

Tropical and subtropical areas are most likely to be affected, and these regions are already witnessing significant declines in marine fish stock. Climate pressures aren't the only stressors – a plethora of studies suggest changes in governance and management systems could have more significant short-term impacts on fisheries than climate change. In this context, developing science today to help better manage the oceans of the future is crucial. Yet, how fisheries are affected by climate is rarely quantified, and very little is known about the impact of governance structures on fisheries' ability to be climate-ready. During his AXA Unesco Fellowship on Coastal Livelihoods at Lancaster University, Dr Emmanuel Mbaru, an environmental social scientist and senior fisheries scientist at Kenya Marine and Fisheries Research Institute, is measuring the impact of climate change on fisheries. Focussing on Kenya, Tanzania and Mozambique, where impacts are expected to be more severe, Mbaru has been drawing from the latest progress in climate modelling, notably using a tool called the climate-biodiversity-fisheries-economic impact model, to empirically quantify the impact of climate on fisheries. Mbaru is also using emerging concepts in natural resource management to better understand how governance, adaptations, and mitigation measures feed into each other within fisheries systems. He, for instance, looks at interactive governance – the study of how different actors working together, influenced, constrained, or enabled by their structures, can solve problems or create opportunities within their society – and institutional bricolage – an approach that looks at how actors beyond the formal institutional structures, e.g. in modern and traditional, formal and informal institutions, can influence governance. As part of this work, Mbaru dove deeply into structural elements of the regional fisheries bodies in the Western Indian Ocean (WIO). He found these bodies already had many elements in place to effectively govern fisheries to respond to climate change, but he identified considerable technical, political, and socioeconomic barriers limiting the pace and scope of their efforts. In addition, three important findings emerged from the reviews: 1) the WIO region is not very advanced in efforts to improve the governance of transboundary fisheries under climate change, however there are positive signals for the future; 2) considerable technical, political, and socioeconomic barriers undermine the pace and scope of timely responses to climate-related changes to transboundary stocks; 3) increased international cooperation is needed for the development and implementation of climate mitigation and adaptation strategies through the exchange of data, research, and best practices. On key barriers and solutions to addressing global sustainability challenges among regional fisheries governance institutions in the face of climate change, the following key findings emerged: 1) the fragmented and decentralized governance systems in the WIO are ill-equipped to foster an international strategy for climate mitigation and adaptation; 2) differences in institutional characteristics, policy frameworks, and evolution of conservation and management measures do not hinder international cooperation across RFBs (request for bids), but highlight the need for interactive governance as a basis for multi-stakeholder collaboration; 3) interactive governance can provide for greater learning and cross-influence among different units, levels, and forms of governance institutions in the face of new global challenges.

The study further combined multi-level network interactions and network activity to advance effective institutional integration in transboundary fisheries governance under climate change. Network interactions were captured through collaboration and communication ties across institutions. Network activity focused on interactions on climate mitigation and adaptation, policy and governance, climate change threats, and fishing rules across governance levels. There were more close-knit communities and fewer influential actors in collaboration networks than communication networks, where influence seems more widespread. Organizations at the same level of governance had a strong tendency to interact primarily among themselves. The engagement of national-level/government actors is more extensive across all networks, whereas international-level actors, including regional fisheries bodies, retain an important responsibility in transboundary climate governance. Mitigation and adaptation networks were more fragmented than other policy interactions, reinforcing the potential mismatch between governance systems and climate change responses. These findings provide initial evidence that jurisdictional boundaries can potentially create barriers to cross-level interaction. Importantly, there is a need for regional and international institutions to consider integrating weaker local-level interests in centrally dominated governance processes to achieve effective climate change policy responses at the regional level and beyond.

"INTERNATIONAL-LEVEL ACTORS, INCLUDING REGIONAL FISHERIES BODIES, RETAIN AN IMPORTANT RESPONSIBILITY IN TRANSBOUNDARY CLIMATE GOVERNANCE."

Mbaru uses this expertise to help advise the Miamba Yetu: Sustainable Reef Investments program, a US$40 million investment vehicle funded by the Global Fund for Coral Reefs that supports businesses benefiting coral reefs in the WIO. He is also sharing his knowledge with the FishSCORE Network, a forum for information exchange about climate-ready fisheries.

FIND OUT MORE

MARINA SANZ-MARTÍN
SPANISH INSTITUTE OF OCEANOGRAPHY,
SPANISH NATIONAL RESEARCH COUNCIL (IEO-CSIC),
SPAIN

Climate-smart strategies to develop resilience in *artisanal fisheries* of Mediterranean marine protected areas.

Fishing is a vital part of Mediterranean coastal life, supporting over 180,000 livelihoods and generating an industry worth €4.6 billion annually. It is also one of the most climate-sensitive marine regions in the world, warming at a rate two to three times faster than the global average. Rising temperatures, sea level increases, and ocean acidification are disrupting marine life, altering species distributions, and challenging traditional fisheries. Marine Protected Areas (MPAs) have been shown to help mitigate these impacts as well as sustain small-scale fisheries and restore overexploited stocks but often lack a focus on climate change.

Dr. Marina Sanz-Martín, an AXA research fellow at the Spanish Institute of Oceanography (CSIC), led the CLISSARTES project, carrying out extensive analysis of long-term data to identify vulnerabilities in fish populations, and forecast species shifts based on changes in ocean conditions. Her research, published in Ecological Indicators, analyzed distribution changes of 102 demersal species in the Western Mediterranean from 1994-2019, including commercially important fish like Hake, Red Mullet and Sole. She found that many of these species are moving southward and southwestward to maintain their preferred depths and temperatures, despite their adaptability to changing conditions.

As fish relocate, fishermen must follow them to new areas, leading to longer trips, higher fuel costs, and greater operational expenses. Alarmingly, many species are shifting toward more environmentally unstable and vulnerable regions, potentially putting at risk commercially valuable species. Such climate-driven migrations may cause certain areas to become less productive, reducing fishing opportunities for local communities that rely on stable stocks. As such, Dr. Sanz-Martín is identifying zones with stable environmental conditions, known as marine climate refugia, to protect these havens for species that need them the most. By connecting scientific

"NEW REGULATIONS TO CONTROL FISHING ACTIVITIES COULD INVOLVE DYNAMIC QUOTAS TO ADJUST CATCH LIMITS BASED ON REAL-TIME CLIMATE AND STOCK ASSESSMENTS, OR CLIMATE CORRIDORS TO PROTECT MIGRATION ROUTES FOR SPECIES AS THEY MOVE."

research on marine refugia with existing conservation approaches, she advocates for the development of "climate-smart" MPAs that impose new regulations to control fishing activities. This could involve dynamic quotas to adjust catch limits based on real-time climate and stock assessments, or climate corridors to protect migration routes for species as they move. Hence, indicators such as 'climate velocity' data are key for future policies to ensure adaptation plans are region-specific and develop conservation strategies to secure fish stocks and coastal livelihoods before 2030.

Beyond her research, Dr. Sanz-Martín has been an active contributor to the scientific community. She has presented her findings at several major conferences, including the 9th World Fisheries Conference, the Ocean Decade Conference, and Effects of Climate change in the World's Ocean Conference Fish Forum 2024. Additionally, she has co-authored several scientific publications, engaged with stakeholders through workshops and collaborative initiatives and given talks to the general public to bring science closer to society.

Nowadays, she is expanding her research through two visiting postdoctoral positions, at Marine Hopkins Station at Stanford University and at the School of Marine and Atmospheric Sciences at Stony Brook University, where she investigates the velocity of climate change and potential marine climate refugia for biodiversity and in fisheries. She is now seeking grants to continue her work and build stronger research collaborations between Stanford University, Stony Brook University and CSIC.

FIND OUT MORE

MEGNAA MEHTTA
INSTITUTE OF RISK AND DISASTER REDUCTION (IRDR) AT UCL, UNITED KINGDOM

Rethinking conservation *amid rising seas* and *women's struggles* on South Asia's coast.

The Sundarbans, a vast mangrove forest spanning India and Bangladesh, is a crucial conservation area but also home to millions facing increasing climate threats, including land loss due to coastal erosion. Conservation policies, designed to protect the ecosystem, often overlook the needs of those who live alongside the forests, act as its guardians and depend on it for the subsistence of their households.

Dr. Megnaa Mehtta, a social anthropology lecturer at University College London, researches the intersecting crises of climate, consumption, and conservation, and how these impact the daily realities of coastal communities. She focuses on women's realities – their hardships and their forms of everyday adaptation – as it relates to men's migration trajectories away from the coastlines of the Sundarbans. Supported by an AXA-UNESCO fellowship, she uses long-term ethnographic research to examine how varied stakeholders and policies implemented by the Forest Department, port authorities, engineers, environmental NGOs, regimes of climate adaptation and local governance have an impact on forest-based livelihoods alongside agrarian distress.

One strand of her research has interrogated top-down conservation policies and the impact of India's 1972 Wildlife Protection Act and the 'Project Tiger,' on communities who live alongside conservation hotspots such as the Sundarbans. Based on two years of ethnographic fieldwork in coastal villages and several shorter visits over a period of seven years, her research highlights the lives of those that are disadvantaged as a result of conservation regimes. She has also argued for activists, NGO workers and mainstream conservation actors to pay attention to traditional forms of resource use. In the Sundarbans forests, governance is centred on forest deities like Bonobibi and the tiger-demon Dakshin Rai – who alongside Wildlife Protection Laws also enforce a "moral ecology." These demons and deities guide how people harvest forest resources through stories, rituals and taboos. In a journal article, Dr. Mehtta argues that this system of "nonhuman governance", that is a form of governance through Bonobibi and Dakshin Rai, encourages restraint and ecological balance, and frowns about greed. However, traditional forms of governance, she cautions, can reinforce caste hierarchies and limit women's freedoms in the Sundarbans and other parts of South Asia. Nonetheless, she suggests that mainstream conservation laws should pay better attention to these traditional frameworks, which would foster better environmental stewardship.

Beyond academic scholarship, Dr. Mehtta's research has contributed to highlighting the need for environmental litigations on a range of conservation and climate justice issues in the region. Dr. Mehtta collaborates with West Bengal-based NGO DISHA as well as the fishers' union DMF on an ongoing litigation supporting the lawful right to compensation for women whose husbands have been victims of tiger attacks in the mangrove forest. After years of litigation, Dr. Mehtta's collaborators – Kolkata-based litigators – have recently won a legal battle for compensation on behalf of three such rural women. More than 6,000 people may have been killed by tigers in the Sundarbans over the past five decades and even today the death toll, hidden by the Forest Department, ranges from 10-25 people annually.

"MAINSTREAM CONSERVATION LAWS SHOULD PAY BETTER ATTENTION TO TRADITIONAL FRAMEWORKS WHICH WOULD FOSTER BETTER ENVIRONMENTAL STEWARDSHIP."

In collaboration with Delhi and Kolkata-based litigators and The Prameya Foundation, Dr. Mehtta is also working on a litigation that pushes for more stringent rules around the movement of ship vessels on the rivers neighbouring the Sundarbans mangrove forest. These vessels carrying toxic fly ash often capsize in the waters causing incalculable environmental degradation. Their movement is also the cause for land erosion. She emphasizes the need for conservation and climate adaptation regimes to safeguard the lives and livelihoods of vulnerable coastal communities in addition to the regions' biodiversity.

Dr. Mehtta will draw from this work in her upcoming book, Conserving Life: Political Imaginaries from a Submerging Forest, where she highlights the need for more expansive and just forms of conservation.

FIND OUT MORE

MICHELA RAVANELLI
SAPIENZA UNIVERSITY OF ROME, ITALY

Mitigating *tsunami threats* and destructive impacts through an enhanced *navigation satellite* system.

Tsunamis may be rare, but their impact is catastrophic. Over the last century, 58 events have claimed an average of 4,600 lives each, with millions exposed to the threat every year. The United Nations warns that by 2030, half the world's population will live in coastal regions vulnerable to these disasters, putting $4 billion in assets at risk annually. Yet, traditional tsunami warning systems, reliant mostly on seismic and sea-level data from seismometers, buoys, and tide gauges, often fall short, leading to delayed alerts, missed events, and false alarms. To close this gap, more reliable technologies are needed.

To that aim, Dr. Michela Ravanelli has been leading the ALTRUIST project, a groundbreaking initiative leveraging the power of satellites for better tsunami detection. While they are typically used for navigation, ALTRUIST employs GNSS satellites to detect atmospheric changes triggered by earthquakes and tsunamis to enhance tsunami warning systems. Developed at Sapienza University of Rome, it is built on a cutting-edge method that combines data from ground shaking, co-seismic displacements, and ionospheric disturbances. During her AXA Research Fund and UNESCO fellowship, Dr. Michela Ravanelli refined the technique to pinpoint the exact atmospheric altitude where tsunami-related disturbances occur.

Tested in Guadeloupe, her prototype demonstrates promising potential to complement existing tsunami early warning systems. It will contribute to more accurate and timely detection, thereby supporting a more integrated approach to global tsunami preparedness. The goal is to scale this technology across tsunami-prone regions worldwide such as New Caledonia in the South Pacific, transforming how coastal communities predict and respond to these deadly events.

Moreover, her 2024 paper presents a deep learning algorithm that transforms GNSS satellite data into images, enabling automatic

monitoring and detection of perturbations caused by tsunamis in the ionosphere. Using data from four major tsunamigenic earthquakes – the 2010 Maule, 2011 Tohoku, and 2012 Haida-Gwaii and 2015 Illapel events – her framework successfully detected ionospheric disturbances with high accuracy. This research marks a significant step forward in using GNSS satellite data, offering a powerful tool for tsunami early warning and seismic monitoring.

Beyond this project, Dr. Ravanelli is shaping the future of geoscience, forging collaborations with ETH Zurich, INGV Etna Observatory, IPGP and GeoAzur. As Chair of the IAG Joint Study Group T.36, she is driving innovation in atmospheric and ionospheric research while actively engaging with related initiatives. This year, she presented her work at a number of international meetings, including the UN Ocean Decade Conference, positioning ALTRUIST at the forefront of global tsunami early warning efforts.

"A DEEP LEARNING ALGORITHM TRANSFORMS GNSS SATELLITE DATA INTO IMAGES, ENABLING AUTOMATIC. MONITORING AND DETECTION OF PERTURBATIONS CAUSED BY TSUNAMIS IN THE IONOSPHERE."

FIND OUT MORE

NWAMAKA OKEKE-OGBUAFOR
UNIVERSITY OF LEEDS,
UNITED KINGDOM

Integrating *aquaculture* and *marine capture fisheries* to combat hunger in Sierra Leone and other parts of Africa.

In Africa, over 200 million people rely on marine capture fishing and related industries for their survival. However, many coastal waters, particularly in the West – such as Sierra Leone – are seeing dramatic shifts due to climate change. Species like tuna, sardines, and bonga are migrating away from their traditional fishing grounds, driven by rising sea temperatures that hinder their reproduction. These changes threaten the food security and livelihoods of the local population.

A solution could lie in a combination of sustainable marine aquaculture and responsible capture fishing – an approach that has the potential to boost nutrition, alleviate hunger, and generate income for these vulnerable coastal communities. Dr. Nwamaka Okeke-Ogbuafor's research at the University of Leeds, supported by the AXA Research Fund, is unlocking ocean-based solutions to these issues. Working directly with local communities in Sierra Leone, she is using citizen science to gather data and collaborating with local stakeholders – academics, policymakers, representatives of coastal communities, and government officials – to build solutions from the ground up.

The team conducted extensive fieldwork in three key Sierra Leonean communities, engaging over 300 local stakeholders in interviews, focus groups, and surveys. Locals were skeptical about fish farming due to two main concerns – farm-raised fish, they believed, lacked essential nutrients compared to marine fishing, and many were also concerned by the capital required to invest in the practice. In her 2024 publication in Aquaculture, Fish and Fisheries, Dr. Okeke-Ogbuafor demonstrates that local skepticism was not unfounded, calling for a refocus from an emphasis on increasing production and income to more investment in 'nutrition-sensitive' fish farming. Armed with this knowledge, the research team worked

hand in hand with stakeholders to co-create a Marine Food Security Strategy (MFSS), ensuring local voices were central to discussions. Unlike previous conservation efforts that overlooked community input, this study focuses on empowering local people with the knowledge they need to adapt. As the locals gain a deeper understanding of the causes and consequences of climate change on their fisheries, they began to see the bigger picture – supporting these communities to meet a number of United Nations Sustainable Development Goals.

Together, they are developing a range of practical solutions, from standardized fish farming practices to providing clear, accessible information on the nutritional value of farmed fish – and even designing affordable, collapsible fish tanks tailored to fishermen's needs. Information about aquaculture and marine capture fisheries has been brought to Sierra Leone's Right to Access Information Commission (RAIC), with plans underway to train RAIC staff on how to work with fishing communities, including ensuring accessible information on fish nutrition. This project is proving that when communities are engaged and equipped with the right tools, they can not only survive but thrive, creating a more sustainable and resilient future for both their people and the oceans that sustain them.

"WHEN COMMUNITIES ARE ENGAGED AND EQUIPPED WITH THE RIGHT TOOLS, THEY CAN NOT ONLY SURVIVE BUT THRIVE."

FIND OUT MORE

VALERIE HAGGER
THE UNIVERSITY OF QUEENSLAND, AUSTRALIA

Community forestry to enhance *conservation and restoration of mangroves* for resilient coastal livelihoods.

Mangroves play a crucial role in mitigating climate change by storing carbon and supporting terrestrial and marine biodiversity in tropical regions. These saltwater forests are critical for climate resilience, protecting around 3.5 million people living in coastal areas from storm surges, flooding, and sea-level rise. However, they are vanishing at an alarming rate: around one-third of mangrove forests were lost before 2000, and a further 3.4% decline occurred between 1996 and 2020 due to human activities and climate change. Their decline threatens traditional livelihoods, food security, and the overall health of the ocean.

Dr. Valerie Hagger began her AXA Fellowship at the University of Queensland in January 2023. She has been investigating how community- and Indigenous-based management (often called community forestry) can enhance mangrove conservation and restoration globally. Her research focuses on countries with diverse socio-economic contexts, such as Australia, Madagascar and Kenya, aiming to reverse the ongoing decline of mangroves and bolster the resilience of coastal populations.

A comprehensive global meta-analysis examining 118 case studies across 30 mangrove-holding nations revealed critical factors driving successful community- and Indigenous-based mangrove management. Dr. Hagger facilitated numerous workshops and meetings with international experts and stakeholders to inform this research. Her work included a pivotal study with the Girringun Aboriginal Corporation, which represents nine Traditional Owner groups in northern Australia's coastal region.

This corporation maintains an agreement with government authorities for managing coastal and marine resources within the Great Barrier Reef World Heritage Area. Through interviews with Traditional Owner representatives, Dr. Hagger identified opportunities for Indigenous-led coastal wetland restoration in the Girringun region while documenting the benefits and challenges of their co-management agreement. Her research provided valuable insights into Indigenous governance of coastal ecosystems and highlighted sustainable management practices. In her 2024 paper published in the Journal of Environmental Management, Dr. Hagger identifies prime wetland restoration sites in Australia, analyzing their carbon sequestration potential – known as "blue carbon". Cost-benefit analysis suggested carbon price was high for land currently used for beef production, but that combining carbon credits with other factors including biodiversity and local fisheries could help achieve better incentives. Moreover, Traditional Custodians expressed interest in leading projects, highlighting the importance of Indigenous leadership and collaboration in blue carbon initiatives. In her 2025 paper, she develops an approach to assess biodiversity benefits specifically for coastal wetland restoration that will inform policy for biodiversity certification under emerging nature markets. Dr. Hagger's research has earned her international recognition. She was a key author of a Best Practice Guideline for Mangrove Restoration and a keynote presenter at the International Mangrove Conservation & Restoration Conference. As her research demonstrates, empowering local and Indigenous communities while integrating economic incentives like blue carbon markets is key to reversing mangrove loss. With continued collaboration, these vital ecosystems could be restored, ensuring coastal resilience, sustainable livelihoods, and climate mitigation.

"COMBINING CARBON CREDITS WITH OTHER FACTORS INCLUDING BIODIVERSITY AND LOCAL FISHERIES COULD HELP ACHIEVE BETTER INCENTIVES."

FIND OUT MORE

Discover more from *our supported scientists*

Through a selection of articles, videos and publications, we invite you to explore the impactful work of some of the scientists we have supported in advancing ocean and climate science. Their research addresses some of the most pressing challenges facing our planet's oceans, coasts and communities.

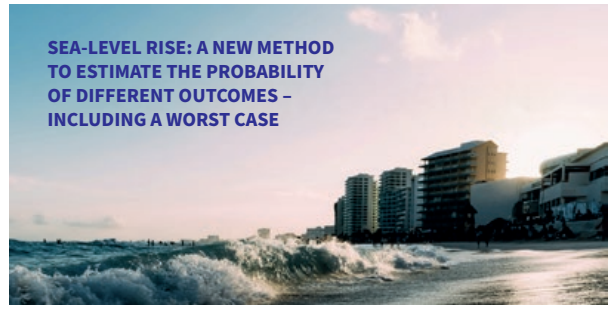
Recent breakthroughs include developing advanced methods to better predict future sea-level rise, equipping decision-makers with stronger tools for planning and resilience; analyzing Antarctic ice cores to reveal how sudden increases in atmospheric CO_2 could affect global climate dynamics; and advancing research on the impacts of climate change on coastal zones, including erosion, flooding, and saltwater intrusion, which threaten ecosystems, infrastructure, and livelihoods.

These examples highlight our dedication to supporting science that informs society and supports policy-making, promoting sustainable action for healthier oceans and more resilient coastal livelihoods.

Join The Conversation *for in-depth articles* on ocean research

The Conversation is a longlasting partner of the AXA Research Fund that provides cutting-edge scientific insights on the key challenges of our times, written by scientists.

In this article, former AXA Chair and Director of the Earth Observatory of Singapore at Nanyang Technological University, Prof Benjamin P. Horton offers projections on the specific rate and magnitude of future sea-level. Given that we will likely exceed 2°C warming, he believes that preparing for more than a meter of sea-level rise by 2100 will prove necessary.



READ THE ARTICLE

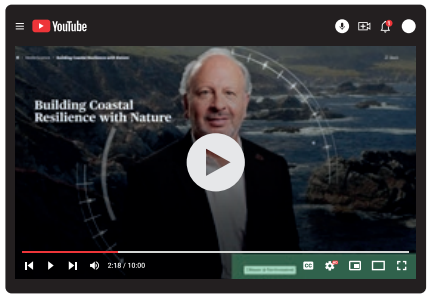
In another article, AXA Award for Climate Science Dr Emilie Capron from Université Grenoble Alpes, CNRS, IRD and Grenoble-INP in France presents her discovery about CO_2 "jumps" in Antarctic ice cores over the last 500,000 years, and how ongoing disruptions could result in another CO_2 jump, potentially exacerbating global warming.

READ THE ARTICLE

Protecting coastlines with *Nature's superpower*

To protect coastlines from the impacts of climate change, research helps leverage the power of nature. This is the approach adopted by the AXA Chair in Coastal Resilience at the University of California, Santa Cruz, which is one of the 250 projects focused on climate and oceans supported by the AXA Research Fund. In this masterclass, Prof. Mike Beck – also Director of the Center for Coastal Climate Resilience – explores the superpower of nature, especially reefs and wetlands, to help protect coastal communities from climate change.

Discover the secrets of mangroves, marshes and oyster reefs in building climate resilience and the importance of investing in green (vs grey) infrastructure solutions. Prof. Beck concludes with an appeal to make Nature Capital Accounting the next big thing in climate change mitigation.



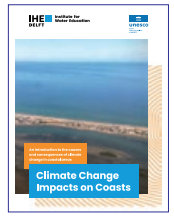
WATCH THE MASTERCLASS ON YOUTUBE

MICHAEL W. BECK

HEAD OF THE AXA CHAIR AND DIRECTOR OF THE CENTER FOR COASTAL CLIMATE RESILIENCE.

"We assess how mangroves, marshes, and coral reefs can protect coastal communities from climate risks. Our work demonstrates that investing in nature-based solutions is cost-effective and identifies where to protect and restore these critical habitats."

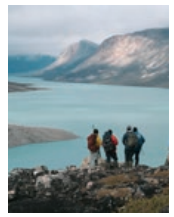
Understand the full *impacts of climate change* on coastlines



READ THE BROCHURE

Climate change will drastically affect coastlines around the world, impacting coastal communities, developments and infrastructure. To avoid massive socio-economic losses in the coming decades, informed and effective adaptation measures urgently need to be developed and implemented. However, risk awareness remains worryingly low. It's crucial that not only frontline professionals but also the general public, and especially younger generations who will face the consequences of climate change, are quickly made aware of coastal vulnerabilities. This comprehensive booklet, supported by the AXA Research Fund and written by AXA Chair Roshanka Ranashinghe at the Institute for Water Education, IHE Delft, aims to fill this knowledge gap.

Explore Sermersuaq, *a 'critical sentinel of our planet's climate'*



WATCH THE DOCUMENTARY

Marc Oliva is a climate scientist supported by the AXA Research Fund, specializing in the study of climate change impacts on polar and high-altitude environments.

Sermersaq is a multi-award-winning documentary that provides a deeply personal perspective on the effects of climate change in the Arctic, intertwining the stories of Michael, a fisherman from Qaanaq – the northernmost town in Greenland – and Marc himself, a researcher dedicated to uncovering the truth. Despite their different paths, both are united by a shared mission: protecting the Sermersuaq, Greenland's vast and vital ice sheet, a critical sentinel of our planet's climate.

Film maker and photo credit: © Patrizia Bruno.

Advancing *ocean wellbeing* through collaboration and advocacy

Beyond the AXA Research Fund's commitment to advancing scientific knowledge, AXA Group actively engages with diverse stakeholders to promote the health and sustainability of the ocean. Recognizing the critical role oceans play in global ecosystems and human livelihoods, AXA has launched and supported several initiatives aimed at addressing pressing environmental challenges.

Partnering with the Tara Ocean Foundation: A Commitment to Marine Biodiversity and Climate Action

Since 2022, AXA has partnered with the Tara Ocean Foundation to support groundbreaking scientific expeditions focused on studying marine biodiversity. These expeditions aim to deepen our understanding of the impacts of climate change and pollution on ocean ecosystems. In addition to advancing research, the partnership seeks to raise public awareness about ocean-related environmental issues, including biodiversity loss, and to foster dialogue between scientists, policymakers, and civil society. This collaboration underscores AXA's dedication to bridging the gap between science and actionable solutions for ocean wellbeing.

Showcasing Ocean Advocacy at the 2025 World Expo in Osaka

As an official partner of the France Pavilion at the 2025 World Expo in Osaka, AXA is amplifying its commitment to ocean sustainability through a unique cultural and educational initiative. AXA sponsors a temporary exhibition on the ocean, developed in collaboration with the Tara Ocean Foundation and renowned artist Jean Jullien. Titled "Osaka Kaiju", the exhibition will run from May 15 to June 11, 2025, and feature an inflatable structure inspired by marine fauna. Accompanied by multilingual awareness messages in French, English, and Japanese, the exhibition aims to engage global audiences in conversations about ocean conservation and the urgent need for collective action.

Supporting IPOS: A Platform for Ocean Governance and Climate Resilience

In 2024, AXA extended its support to the International Platform for Ocean Sustainability (IPOS), a pioneering initiative designed to provide scientific and policy support for ocean governance. Leveraging cutting-edge Generative AI (GenAI) technology, IPOS is working to enhance the climate resilience of coastal states, facilitate dialogue between science, civil society, and public governance, and develop decision-making tools grounded in validated scientific research. By supporting IPOS, AXA is contributing to the creation of innovative solutions that address the complex challenges facing our oceans.

Collaborating on UNOC3 in Nice: A Global Forum for Ocean Action

Further demonstrating its leadership in ocean advocacy, AXA has partnered with the French Ministry for Europe and Foreign Affairs to organize the third United Nations Ocean Conference (UNOC3) in Nice. This global event will bring together policymakers, scientists, and civil society to advance international efforts in ocean conservation and sustainable development.

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It's rising.
Science is not an opinion.
It's our future.
That's why the AXA Research Fund has been supporting independent scientific research since 2008, contributing to make a safer, fairer and more inclusive future for as many people as possible.
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