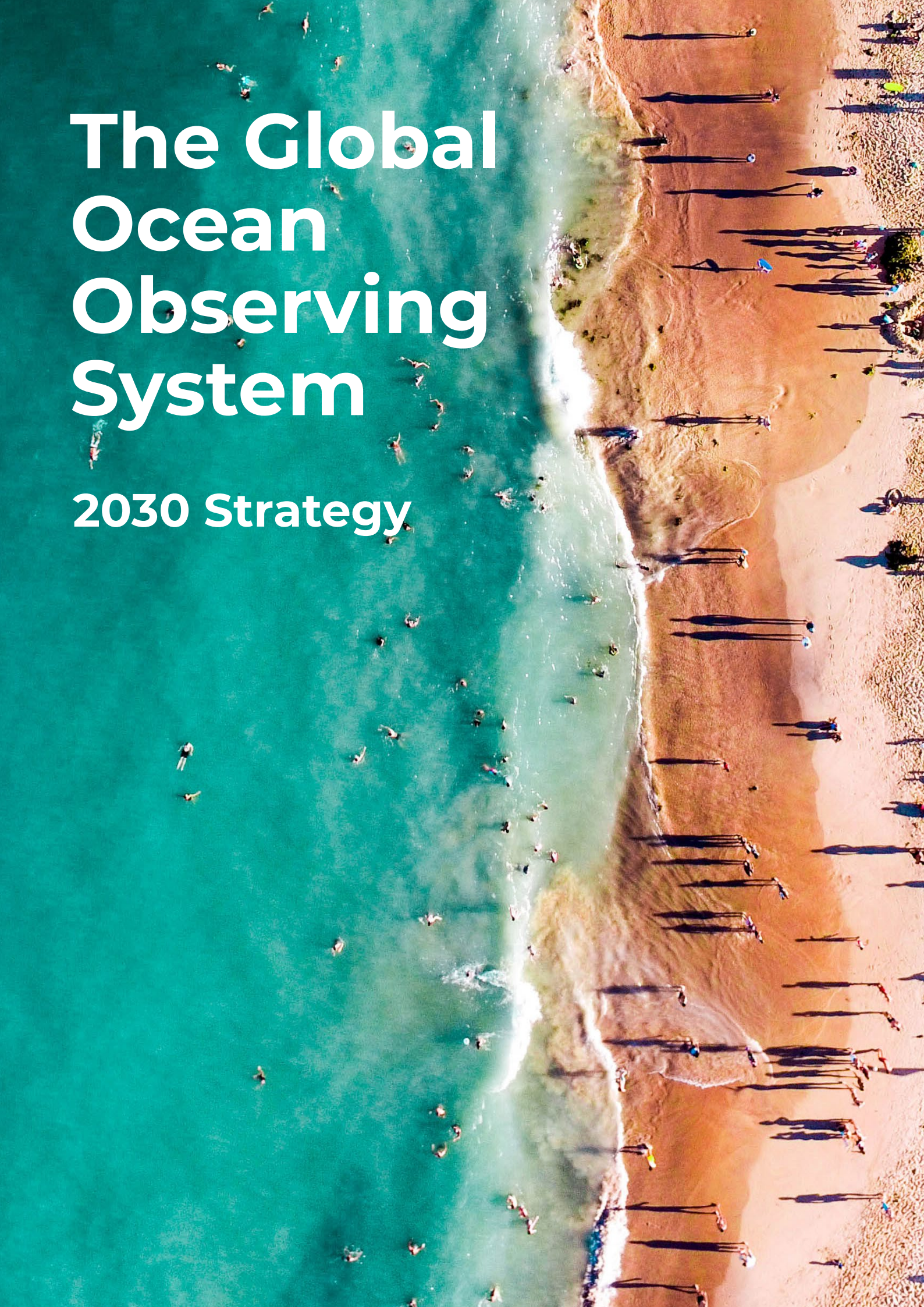
# The Global Ocean Observing System

## 2030 Strategy



# About GOOS

Established in 1991, GOOS is co-sponsored by the Intergovernmental Oceanographic Commission of UNESCO, the World Meteorological Organization, the United Nations Environment Programme, and the International Science Council.

In its first decades, GOOS designed and coordinated the development of a global ocean observing system to support climate science and to serve as the observational backbone for operational forecast systems. In 2012, this success, coupled with growing concerns about the health of oceans and demand for information products to help nations manage their ocean economies, sparked development of the visionary *Framework for Ocean Observing*: a guide to meet the needs of multiple stakeholders. GOOS has since led the implementation of this framework by the ocean observing community, with the goal of serving users across climate, operational services and ocean health, increasingly with a focus on coastal areas and regional seas.

Today, GOOS has four key components:

- expert panels for physics, biogeochemistry, and biology and ecosystems that synthesize across requirements and provide guidance on observing system design;
- the Observations Coordination Group and the GOOS Regional Alliances that implement observing systems and ensure the flow of observations across the global networks and regional observing structures;
- GOOS Projects that advance innovation and expand into new areas for the observing system; and
- core coordination through the GOOS Steering Committee and a distributed GOOS Office.

Through these components GOOS supports a community encompassing all those playing a role in the observing system: international, regional, and national observing programs, governments, UN agencies, research organizations, and individual scientists. By working together on observing tools and technology, the free flow of data, information systems, forecasts, and scientific analysis, this global community can leverage the value of all these investments.

To meet urgent and expanding demands for ocean observations and services, GOOS has looked towards the coming decade and developed this 2030 Strategy. The strategy will guide us, our community, and all those willing to support development of the integrated global ocean observing system required for our safety, wellbeing, prosperity and sustainable future.

The GOOS number is: IOC/GOOS/239

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# FOREWORD

## A call to action for ocean observation

Our ocean, seas and coastal regions are critical to life on Earth, and a rapidly expanding 'blue economy' estimated to be worth $3–6 trillion per year. The cumulative impacts of climate change, development, pollution and overfishing are placing considerable stress on our marine environment. We now know that the trajectory of change and damage threatens the future of our planet and all those that live on it.

The global community, through the 2030 Agenda for Sustainable Development, the United Nations Framework Convention for Climate Change, and many other international, regional and national initiatives, has committed to ensuring that future development is sustainable.

Achieving sustainability at global, regional and local scales will require a comprehensive understanding of the current and projected state of our ocean, seas and coasts. It will also require monitoring the impact of our policies and management actions.

Improving early warnings of floods, droughts, and severe storms – all predicted to increase in warming world – will require expanded ocean observations. The sustainable development of the blue economy, underpinned by ocean information, is a future source of jobs and economic growth.

While we have made significant improvements in our ability to observe and understand the oceans over the past three decades, our current efforts fall well short of what will be required. This *Global Ocean Observing System 2030 Strategy* provides

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the vehicle for designing, building and widening the use of the necessary observations and information systems.

Implementing this strategy will demand a step change in the level and effectiveness of partnerships across the scientific and end-user communities. It will also need a deep commitment to building human capacity and a more multi-disciplinary observing system capability.

If we are to meet the innovation challenges associated with building a fully integrated global ocean observing system, reliance on inter-governmental and government funding – even from the richest of nations – will be insufficient. Backing and expertise from the private sector, including the inspiring contributions of philanthropists, are needed.

Please join us in the challenge of building the observing system our oceans, planet and the global community so desperately need.

**Albert Fischer**
**Program Director**
**GOOS Office, IOC/UNESCO**

**John Gunn and Toste Tanhua**
**Co-Chairs**
**Global Ocean Observing System**

**on behalf of the GOOS Steering Committee**

# WHY A NEW STRATEGY?

A healthy and safe ocean is fundamental to our existence and way of life. The ocean regulates Earth's climate and provides the oxygen for every second breath we take. It provides transport, food and essential space for recreation. More than half of the people in the world live near the coast, and countless communities rely on ocean resources for their economic, physical and social wellbeing.

The ocean is our common heritage and we have a global responsibility for its safe stewardship. It remains the least-known and least-visited part of our planet, and a generator of both wonder and ideas.

## Ocean pressures are mounting

The ocean is changing. Climate change is shrinking ice cover and warming the oceans. It is provoking sea level rise, ocean acidification, deoxygenating large parts of the marine environment, and amplifying weather and climate extremes.

Economic losses associated with extreme weather and natural catastrophes are at record levels, and these are expected to increase with climate change. Extreme weather events, natural disasters, and the failure of climate change mitigation and adaptation are seen as the three greatest risks for nations in the coming decade. Human pressure on the ocean is degrading habitats, increasing plastics and other pollutants, over-exploiting fish populations, and causing the death of coral reefs and wider declines in marine biodiversity.

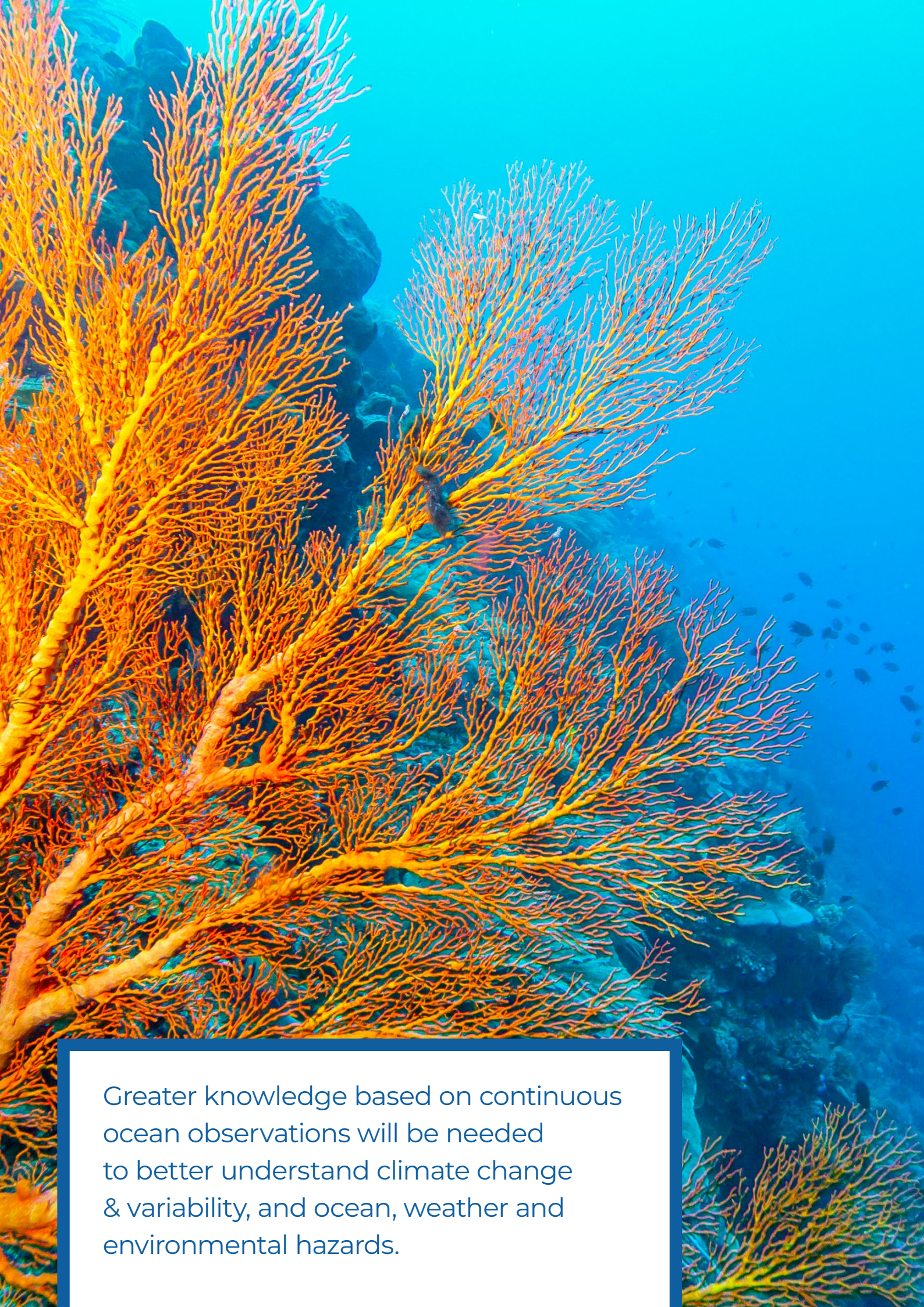
Without concerted action, these pressures will intensify in coming decades as the world's expanding population continues its march into coastal regions. At the same time, governments, policymakers, investors and communities – especially those in small island nations – are looking to the ocean for food security and economic opportunity.

## Enabling resilient and sustainable blue economies

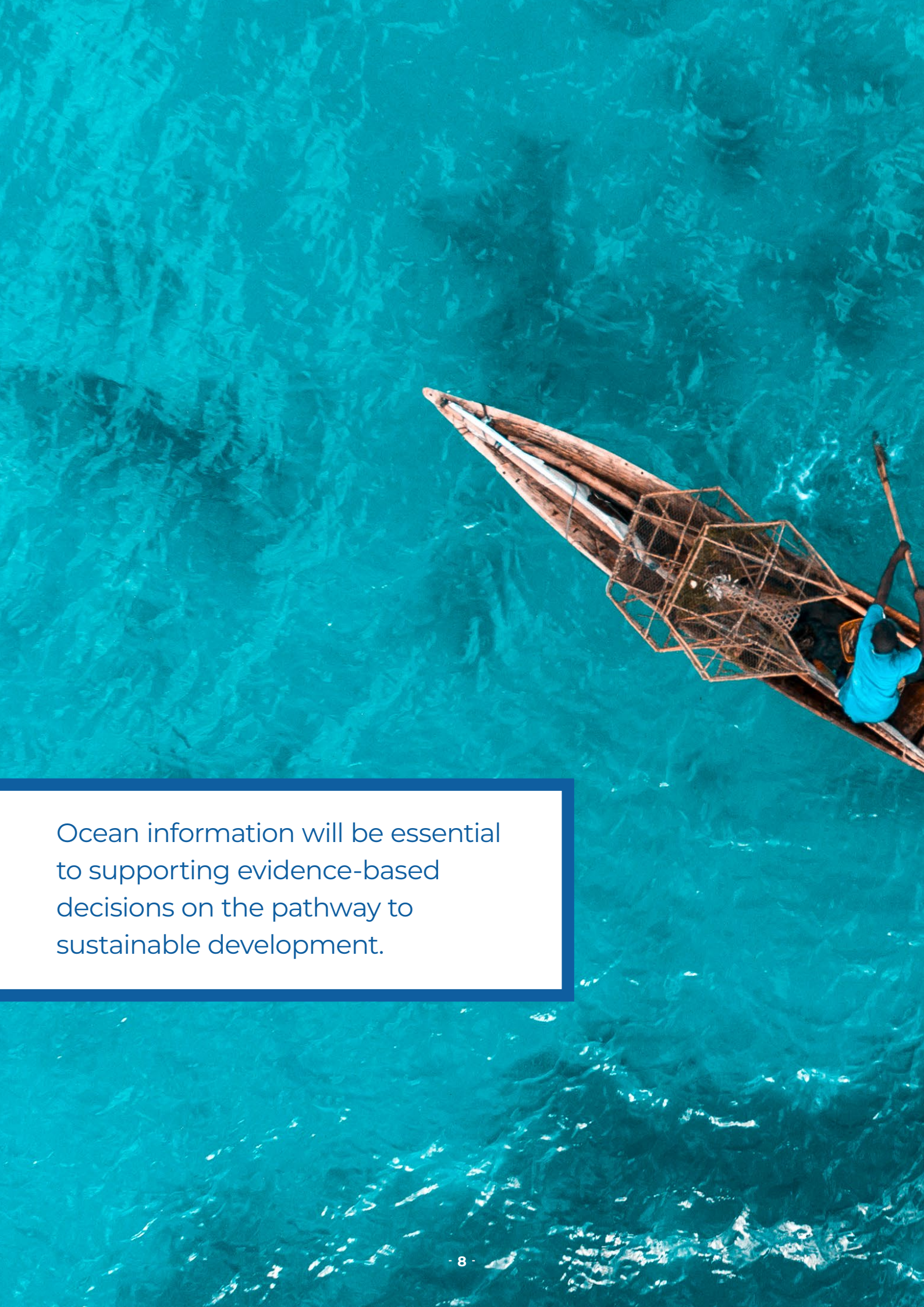
Long term ocean observations allow us to better understand climate change and variability, and improve our forecasting of climate, weather, ocean status and environmental hazards and their impacts. Developing our ability to provide relevant information at global, regional, and down to coastal scales, is vital to addressing local needs and building resilience.

Ocean information supports good policy and provides an evidence base for real-time decision-making, tracking the effectiveness of management actions, and guiding adaptive responses on the pathway to sustainable development.

In addition to supporting sustainability, ocean knowledge and information have the power to generate profits and jobs in the marine economy. By 2030, the ocean economy, buoyed by growth in tourism, mariculture and renewable energy, is predicted to be a much larger component of our national economies.



Greater knowledge based on continuous ocean observations will be needed to better understand climate change & variability, and ocean, weather and environmental hazards.



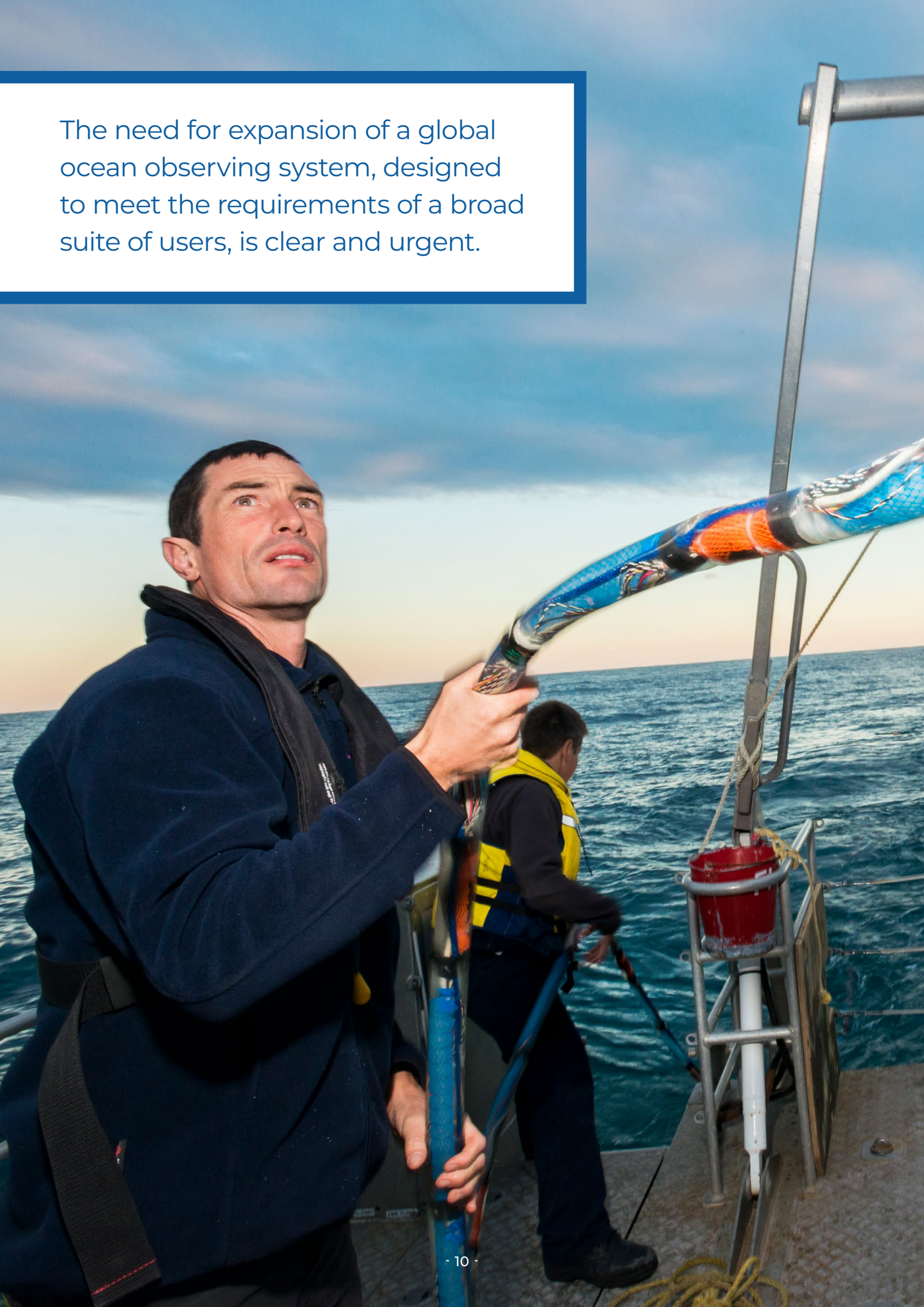
Ocean information will be essential to supporting evidence-based decisions on the pathway to sustainable development.

## The world needs a step change in ocean observing

In the past three decades, the global science community has made good progress on the development and coordination of ocean observations. Today, these observations provide the backbone for ocean and weather forecasts, deliver understanding of the ocean's role in the global climate system, as well as the climate's impact on the ocean. The number and size of regional and national observing systems has grown in response to local needs, as has the recognition that a global network is essential.

It is clear however, that to meet the growing demands of policy makers, private sector users and the general public, we need a step change in the breadth and extent of the ocean observing system. We need a fully integrated global observing system that captures essential physical, chemical, biological, and ecological ocean properties, from global to local coastal scales. The data produced need to be freely available for use in developing a range of assessments, forecasts, data products and services. We need to integrate information on human pressures and support more states in developing observing capacity.

The need for expansion of a global ocean observing system, designed to meet the requirements of a broad suite of users, is clear and urgent.



## Now is the time to act

The need for an expanded global ocean observing system designed to meet the requirements of a broad suite of users is clear and urgent. This expansion will be a major challenge, both in terms of resourcing and capacity development.

Meeting the challenge will require the scientific community, governments, private sector partners and the public to work closely together. Such a broad collaboration would have been unlikely when the global ocean observing system was first developed in 1991.

Now, the rapidly growing public awareness of the threats posed by climate change presents an opportunity to mobilize the world into action. Without the proposed expansion we run the risk of basing sustainable development, enhanced resilience and blue economic growth on little more than guesswork.

Similarly the UN Decade of Ocean Science for Sustainable Development 2021-2030 is a call for action, within the science community and beyond, in order to face the challenges placed upon our oceans by combined climate and human pressures, and to define a new and sustainable future for the ocean and the life it supports.

# OUR VISION

A truly global ocean observing system that delivers the essential information needed for our sustainable development, safety, wellbeing and prosperity

We envision a global ocean observing system in 2030 that is responsive to the needs of end users. Information relevant to climate, operational needs, marine ecosystem health and human impacts will flow from locally and remotely sourced ocean observations.

Increased monitoring and knowledge of the major atmospheric and ocean processes and their interaction will make seasonal forecasts more accurate, improving planning in farming, construction, insurance, and public health, and in water, ecosystem and wildfire management.

New, lower-cost technologies will greatly enhance our capability to observe the oceans. Networks of gliders, autonomous underwater vehicles, Argo floats, moorings and research platforms – all equipped with low-power sensors and artificial intelligence – will send real-time or near-real-time measurements to open databases, complementing satellite observations of the ocean surface. Parts of the sampling system will automatically adjust to changing needs.

The public will have access to the same information as policy makers; in fact they may be part of the process, taking observations locally. They will have a myriad of information at their fingertips, enriching their experience and supporting marine based activities and choices.

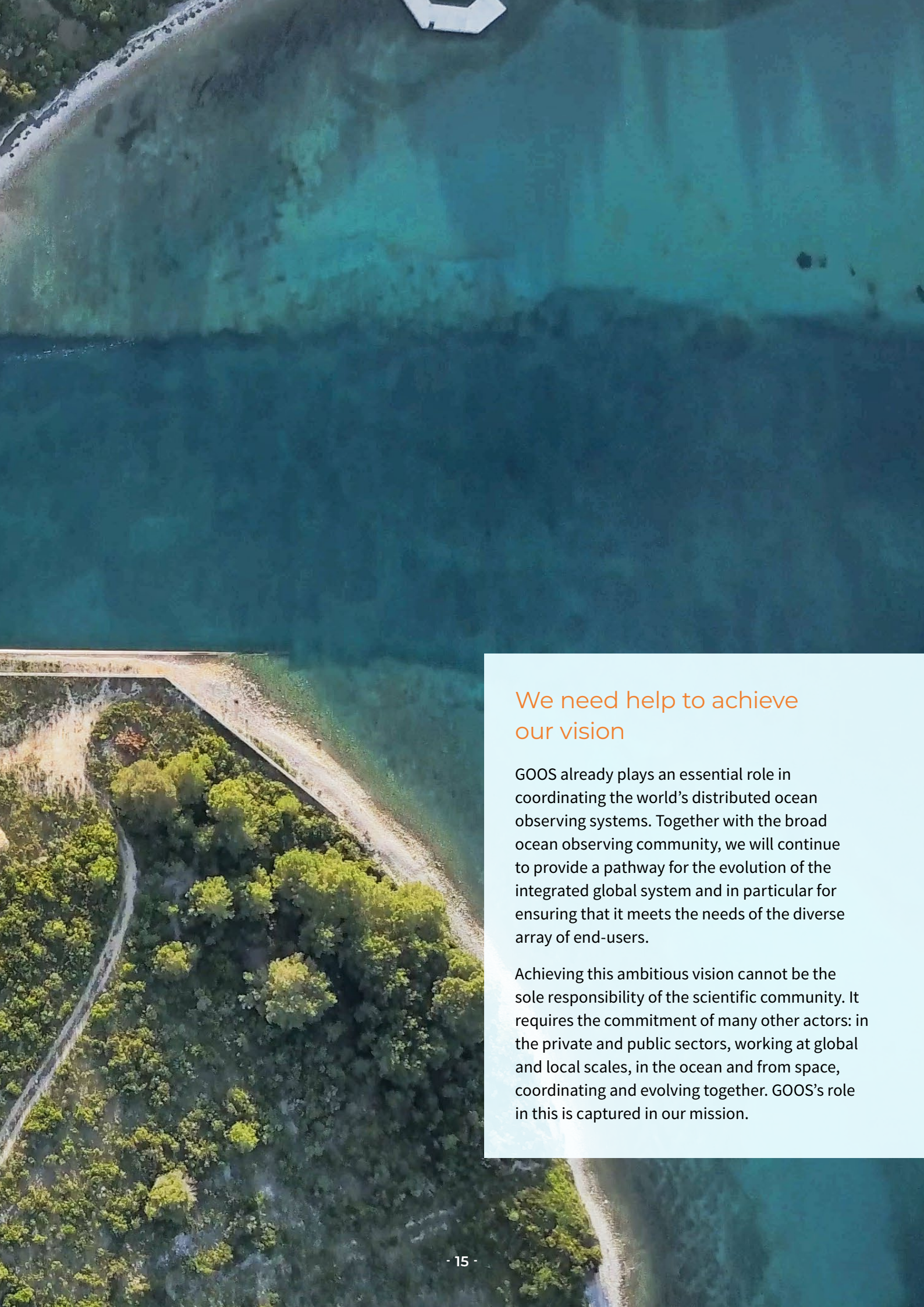
Parallel major ocean capacity development programs, such as the UN Decade of Ocean Science for Sustainable Development 2021-2030, will help boost the capability of every nation

to make and use available ocean observations, as well as the partnerships needed to improve delivery and use.

The increased value of ocean observations to national economies will also encourage nations to share data on Essential Ocean Variables collected in national waters and beyond.

With new partnerships and participation involving all nations, we envision this fully integrated 2030 ocean observing system as providing the critical ocean information needed to mitigate and adapt to climate change, generate a suite of improved environmental forecasts, protect ocean health and support sustainable growth.

We envision this fully integrated 2030 ocean observing system as providing the critical ocean information needed to address climate change, generate forecasts, protect ocean health and support sustainable growth, and with new partnerships and participation involving all nations.



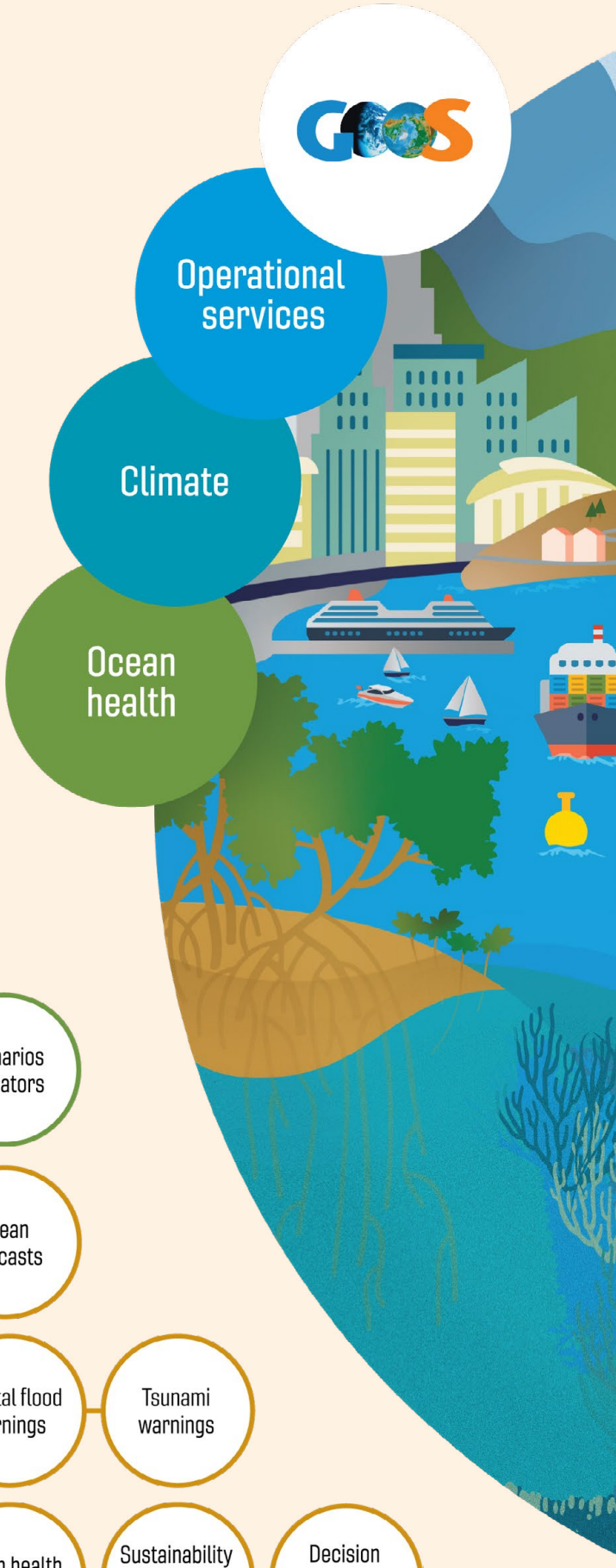
## We need help to achieve our vision

GOOS already plays an essential role in coordinating the world's distributed ocean observing systems. Together with the broad ocean observing community, we will continue to provide a pathway for the evolution of the integrated global system and in particular for ensuring that it meets the needs of the diverse array of end-users.

Achieving this ambitious vision cannot be the sole responsibility of the scientific community. It requires the commitment of many other actors: in the private and public sectors, working at global and local scales, in the ocean and from space, coordinating and evolving together. GOOS's role in this is captured in our mission.

# What does global ocean observing look like?

A fully-integrated ocean observing system will deliver ocean information across three key application areas: operational services, climate, and ocean health.




Research and innovation

- Observations
  - Satellite and in situ networks
  - Global Regional National
- Data Management
  - Archives
  - Real-time data systems
- Analysis, Models
  - Ocean and coupled climate models
  - Reanalysis Projections
  - Scenarios Indicators
- Applications
  - Climate forecasts
  - Weather forecasts
  - Ocean forecasts
  - Harmful algal blooms
  - Severe storm warnings
  - Coastal flood warnings
  - Tsunami warnings
  - Disaster risk assessment
  - Environmental risk assessments
  - Ocean health assessments
  - Sustainability indicators and tools
  - Decision support systems

# THE GOOS MISSION

To lead the ocean observing community and create the partnerships to grow an integrated, responsive and sustained observing system

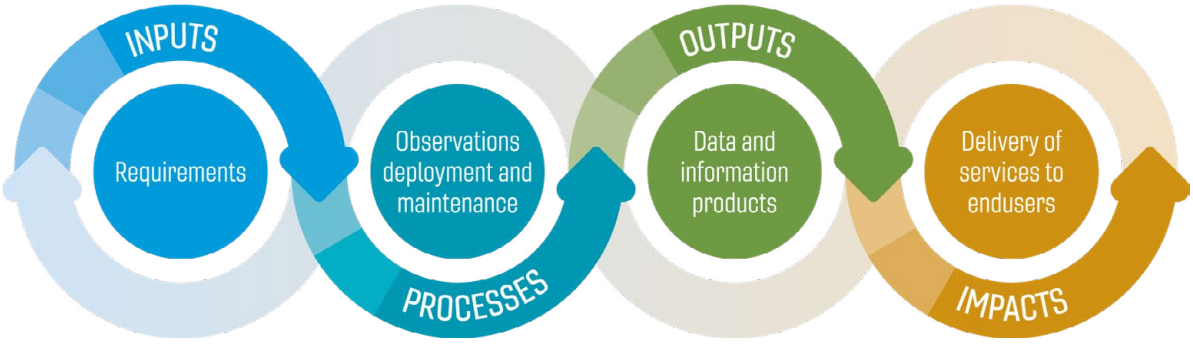
To achieve our vision for the ocean observing system, GOOS will evolve over the next decade to offer more inclusive governance, and increased expertise, engagement, communication and capacity development. GOOS will also engage with existing and new partners to support delivery of the strategy.

Evolution in the governance and coordination of the observing system will simplify its design, implementation, data and product delivery, and performance evaluation. This, together with a coordinated approach to communicating the need for ocean observations, and how they benefit society, will focus end-user engagement at local to global scales. GOOS will strongly advocate for longer-term funding for the components of the observing system, as users increasingly rely on ocean information and forecasts.

We aim to provide one integrated system that delivers ocean information across three key application areas: operational services, climate, and ocean health. The system will link local, national and global initiatives monitoring physical, chemical and biological properties, from the coast to the open ocean. It will serve the full ocean observing value chain, from measurement through to data management and modelling, for end users from climate to ocean health.

Through building community consensus, GOOS will enable stakeholders to engage with the system as a whole, providing a powerful impetus for greater funding and participation. This involves working together on observing tools and technology, the free flow of data, information systems, forecasts, and scientific analysis. The process of sharing best practices and innovation across the observing system will allow each individual piece to contribute at its highest capacity.

To guide our actions, our broader community, and our current and future partners, GOOS has developed 11 Strategic Objectives which outline the key areas of activity to implement this strategy. We believe some objectives will involve significant partnership.



We aim to provide one integrated system that can deliver ocean information across three key application areas: operational services, climate, and ocean health.


Authoritative guidance on design
Open data
Strengthen observing implementation
System integration and delivery
Observe human impacts
Champion effective governance
Guide capacity development
Building for the future
Support innovation
Advocacy and communication
Evaluate impact
Empower end user applications
Deepening engagement and impact
Strengthen partnerships for delivery

# STRATEGIC OBJECTIVES

## DEEPENING ENGAGEMENT AND IMPACT

Deepen engagement and partnership from observations to end users to advance the use and impact of the observations and demonstrate their benefits

1. Strengthen partnerships to improve delivery of forecasts, services, and scientific assessments.
2. Build advocacy and visibility with stakeholders through communicating with key users and national funders.
3. Regularly evaluate system impact to assess fit for purpose.
4. Strengthen knowledge and exchange around services and products, to boost local uptake.

## SYSTEM INTEGRATION AND DELIVERY

Deliver an integrated, 'fit-for-purpose' observing system built on the systems approach outlined in the *Framework for Ocean Observing*

5. Provide authoritative guidance on integrated observing system design, synthesizing across evolving requirements and identifying gaps.
6. Sustain, strengthen and expand observing system implementation through GOOS and partner communities, promoting standards and best practice, and developing metrics to measure success.
7. Ensure GOOS ocean observing data and information are findable, accessible, interoperable, and reusable, with appropriate quality and latency.

## BUILDING FOR THE FUTURE

Building for the future through innovation, capacity development, and evolving good governance

8. Support innovation in observing technologies and networks.
9. Develop capacity to ensure a broader range of beneficial stakeholder participation.
10. Extend systematic observations to understand human impacts on the ocean.
11. Champion effective governance for global in situ and satellite observing, together with partners and stakeholders.

# WORKING TOGETHER FOR A BETTER FUTURE

GOOS has led the ocean observing community for three decades and has prepared the way to tackle these new challenges.

Our path towards this future will focus on achieving the strategic objectives, and will be detailed in the GOOS Implementation Plan, built in consultation with our community, partners and stakeholders.

It will take a coordinated and substantial effort to achieve these objectives, and we invite you to join us and contribute to achieving this vision.

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

WMO

UN environment

International Science Council



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