Theme 1: Addressing Ocean Plastic Pollution

Plastic pollution, in particular ocean plastic pollution, is a global problem. Plastic pollution affects environmental and food security, maritime transportation, tourism, economic stability, resource management, and potentially human health.

As part of his introductory remarks at the UN Environmental Program (UNEP) Ocean Plastics Event in Nairobi, Kenya, on November 18, 2021, U.S. Secretary of State Antony Blinken stated that:

> "It's estimated that we add between eight and fourteen million tons of plastic pollution to the ocean every single year. That's about one truckload dumped in the sea every minute of every day, and that rate is increasing, not decreasing. Plastic can take anywhere from decades to millions of years to break down. In that time, waste is carried everywhere from Antarctica to the Marianas Trench. Some of it is caught in massive swirling sea currents. The biggest one, the Great Pacific Garbage Patch, is spread across an area three times the size of France.
>
> The negative effects of plastic pollution on sea life and on human beings are serious. Much of the plastic at sea is broken down into tiny pieces that sea animals eat. These microplastics can tear apart animals' organs, clog their intestines, and give them the illusion they're full, causing them to starve to death. And because plastics absorb toxins, when we eat seafood, we're not only consuming microplastics, but toxins as well. In addition, plastic pollution can hurt small-scale fishing and discourage tourism to coastal areas."

Status and trends

Globally, plastic waste is either disposed of in landfills, incinerated, placed in unmanaged dumps, or littered. Only 16% of global plastic was collected for recycling in 2016 (Hundertmark et al, 2018)[1]. Plastic waste and scrap can leak into the environment and oceans from land-based sources (e.g. littering and illegal dumping, mismanaged waste, storm water discharge, and natural disasters) or ocean-based sources (e.g. offshore oil and gas platforms, ships, derelict fishing gear, and abandoned and derelict vessels). According to the Ocean Conservancy, 80% of ocean plastic pollution comes from land-based sources and 75% comes from waste that was never collected[2].

Challenges and opportunities

Addressing Plastic Pollution at the UN Environmental Assembly (UNEA)

Plastic pollution that enters the ocean does not respect political boundaries; as such, addressing plastic pollution is a global challenge that requires international cooperation. We must come together as a world to find innovative solutions to this growing problem. Secretary Blinken announced in November of 2021 that the United States supports launching negotiations on a global agreement to combat ocean plastic pollution. The resumed fifth session of the UNEA

---

[1] https://www.mckinsey.com/industries/chemicals/our-insights/how-plastics-waste-recycling-could-transform-the-chemical-industry

[2] https://oceanconservancy.org/wp-content/uploads/2019/10/Plastics-Policy-Playbook-10.17.19.pdf

meeting in February 2022 (UNEA 5.2) provides that opportunity to mobilize negotiations on global action to address ocean plastic pollution. The United States supports standing up an international negotiating committee at UNEA 5.2 to begin work on a global agreement that is innovative, ambitious, and enables a bottom-up approach that provides flexibility for countries to contribute to a common objective through national action plans and country-driven approaches. Stakeholder engagement and technical and financial support for countries most in need are also critical to our success.

Abandoned, Lost, or Discarded Fishing Gear (ALDFG)
As a part of combating sea-based sources of waste, the UN Ocean Conference should also address ALDFG. In addition to being a significant form of ocean plastic pollution, ALDFG has a detrimental impact on marine ecosystems, continuing to entangle marine life. A variety of factors (i.e. fishing effort, gear type, gear configuration, economic conditions, on-water activity from other fishers/recreational users) determine the rates and species impact of ALDFG. It is difficult to quantify generally the proportion of ALDFG to other types of marine debris; however, one recent study shows that ALDFG makes up a substantial portion of marine debris by weight.[3] Properly designed and implemented gear marking systems are a key fisheries management tool that can contribute to reducing the impacts of ALDFG in the marine environment, and implementation of the UN Food and Agriculture Organization's (FAO) Voluntary Guidelines on the Marking of Fishing Gear and its work to develop a global strategy to address ALDFG should be reflected in the discussion under theme one.

Monitoring
Another key area where science and innovation can spur efforts to address marine pollution is monitoring. Marine debris monitoring is critical for understanding the scope and scale of the issue, determining hot spots and areas with heavy accumulation to target for priority intervention, and, in the longer term, the impacts of interventions to address marine pollution. This dialogue theme should include discussions of the importance of accurately monitoring marine debris, especially on shorelines and in the coastal water column. One potential guiding question for the theme to consider is how to build national marine debris monitoring capacities around the globe and support regional cooperation and information sharing.

Capacity Building
The United States has a wide array of technology and expertise to assist countries in improving their waste management and recycling systems. The Department of State works closely with colleagues in the U.S. Environmental Protection Agency (EPA); the U.S. Department of Commerce, including the National Oceanic and Atmospheric Administration (NOAA), the International Trade Administration, and the National Institute of Standards and Technology; the U.S. Agency for International Development (USAID); the U.S. Department of Energy; the National Science Foundation, and other agencies, to highlight U.S. expertise and innovation in waste management technologies, materials research, and other cutting-edge solutions.

To date, the Department of State has overseen $6.5 million in past or planned grants to combat marine debris and plastic pollution. Various grants aim to reduce marine debris, including ocean

[3] Lebreton, et al. Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic

plastic pollution, by focusing on key areas identified in addressing the broader issue: data, solutions, and outreach. Projects have deployed solutions to both land- and sea-based sources, including through engaging with the private sector and non-governmental organizations to establish fishing gear recycling programs; implementing best practices to address land-based sources of waste; and the incubation of entrepreneurs developing innovative solutions.

USAID has identified priorities to support developing countries in Africa, Asia, Pacific Islands, Latin America and the Caribbean, as they seek to reduce plastic pollution:

- Formulating data-driven policies for increased circularity. This requires rigorous data collection on sources of pollution, for example single-use plastic formats that are commonly littered, and established mechanisms for the convening of public and private stakeholders to discuss and evaluate policy options.
- Strengthening the capacity of subnational governments to manage solid waste and wastewater in a sustainable, environmental manner. This requires helping cities and other local governments to increase funding levels and investment, optimize operations and expand services, and build or rehabilitate recovery and treatment facilities.
- Protecting informal waste collectors and promoting sustainable social and behavior change for the 3Rs (reduce, reuse, recycle). This requires educating workers and communities, creating safe working conditions, making recycling convenient, and innovating for alternatives to single-use plastics.

Existing partnerships

International Cooperation

The United States has already taken substantial steps to combat ocean plastic pollution—both domestically and internationally. The United States works to build international capacity to counter ocean plastic pollution, including promoting environmentally sound waste management and working to reduce the amount of abandoned, lost, or otherwise discarded fishing gear in the ocean. The United States engages with international counterparts to address plastic pollution and marine debris in international environmental bodies, such as the UNEP, the Land-Based Sources Protocol to the Cartagena Convention, the Association of Southeast Asian Nations (ASEAN), the Asia-Pacific Economic Cooperation (APEC), the Basel Convention, the London Convention/London Protocol, and MARPOL. The United States also participated in the Ad Hoc Open-ended Expert Group on Marine Litter and Microplastics that was established by UNEA 3 in 2017 and extended by UNEA 4 which enabled us to think through the range of options to combat ocean plastic pollution with countries and stakeholders. We have continued that process, and have been engaging in bilateral and stakeholder outreach, including holding large stakeholder meetings over the last year to hear from the private sector, environmental groups, and other members of the public about launching negotiations on a global agreement.

USAID is also supporting several innovative partnerships that create incentives to recover waste so that it can have economic value. One grantee in the Philippines is supporting community collection sites at convenience stores, with the purchase of recyclables supported by local businesses. In Peru, USAID is working with the National Society of Industry to hold private sector engagement informational sessions in support of advancing local circular economies.

Our Ocean Conference, G7, and G20

At the 2019 Our Ocean conference, hosted by Norway, the United States announced 23 new commitments valued at $1.21 billion to promote sustainable fisheries; combat marine debris; and support marine science, observation, and exploration. We also work in the G7 and G20 to tackle marine debris. In the G7, we promote better coordination of various country-level initiatives supporting research on microplastics, improving scientific monitoring, and advocating for better use of resources to recover, reduce, recycle, and repurpose waste. In 2019, at the G20 Leaders meeting, we worked closely with Japan's G20 Presidency to help develop the Osaka Blue Ocean Vision 2050, which aims to reduce additional marine plastic litter pollution to zero by 2050. We also supported the development and adoption of the G20 Implementation Framework for Actions on Marine Plastic Litter and the G20 Resource Efficiency Dialogue aimed at increasing mutual understanding regarding activities and best practices on marine plastic litter.

UNEP's Regional Seas Programmes
The United States, through the Department of State, EPA, and NOAA, engages in relevant UNEP Regional Seas Programmes and in the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA). Regional Seas Programmes provide a helpful mechanism to forge regional partnerships and efforts to better understand and address priority sources of pollution into the marine environment. For example, through the UNEP-administered Regional Seas Convention in the Wider Caribbean (Cartagena Convention), the United States contributes to the design and implementation of a biennial work plan for the Convention's Land-Based Sources of Pollution Protocol. This work, led by the Cartagena Convention Secretariat, leverages regional State action, donor support through mechanisms such as the Global Environment Facility (GEF), and collaboration with other efforts to implement activities to reduce polluted runoff into the shared waters of the Wider Caribbean. This work also supports implementation of a Regional Action Plan on Marine Litter Management. The GPA is an important UNEP effort that strives to address land-based sources of pollution with an integrated, source-to-sea approach. The GPA's Global Partnership for Marine Litter (GPML) is a major global coordination effort focused on increasing the understanding of marine debris and promoting coordinated global, regional, and national action to address it. NOAA serves on the Steering Committee to guide GPML implementation, and along with interagency partners including EPA, contributes to marine litter policy and program development to assist countries in meeting their needs to address marine litter.

Cooperation with Coordinating Body of the Regional Seas of East Asia (COBSEA)
EPA has a cooperative agreement with UNEP where EPA and COBSEA are collaborating to work on small projects in the Southeast Asia region that improve plastics collection and management through small-scale technologies and innovative waste collection frameworks. EPA and COBSEA are also collaborating on a compendium of best practices for innovative work on plastics collection and management in the Southeast Asian region. These best practices will be integrated into UNEP's digital platform.

"Clean Cities Blue Ocean"
USAID's global flagship program "Clean Cities Blue Ocean" has secured 40,000 metric tons of plastic from leaking into the environment and is supporting 20 local organizations in focal countries in Asia, Latin America and the Caribbean. One grantee is advising the Government of Maldives on policies to eliminate single-use plastics by carrying out formative research on how

households interact with single-use plastics. In close collaboration with businesses, the grantee is identifying affordable alternative products to problematic single-use plastics.

Possible areas for new partnerships

The private sector plays an important role in our efforts to combat plastic pollution and increase innovative solutions. We encourage countries to engage with the private sector to fight this problem alongside their government and civil society. Addressing ocean plastic pollution provides opportunities for businesses to innovate and create sustainable supply chains and green jobs across a diverse set of industrial sectors and geographic regions. We must bring the private sector into these efforts to ensure we are inclusive and successful.

While not a UN program, consideration should be made for engaging with the GEF's work on Large Marine Ecosystems to address impacts to fisheries and habitats, especially from marine debris sources, such as ALDFG. While the GEF is not a UN entity, there is significant overlap in particular with the UNEP Regional Seas Programmes.

Finally, USAID is working to support the development and piloting of new policy-based approaches to reduce ocean plastic pollution, such as through Extended Producer Responsibility legislation in Sri Lanka.

Conclusions and recommendations

Achieving and sustaining results will require a local systems approach involving all stakeholders, including subnational governments, the private sector, and informal workers. National policies and global agreements can create incentives for circularity and technical and financial support for strengthening systems.

Key questions for the dialogue at the 2022 UN Ocean Conference

- One potential guiding question for the theme to consider is how to build national marine debris monitoring capacities around the globe and support regional cooperation and information sharing.

Theme 2: Managing, protecting, conserving and restoring marine and coastal ecosystems

The sustainable management of coastal, marine, and freshwater ecosystems and fisheries is critical to biodiversity conservation and sustainable development. The urgency of the intertwined biodiversity and climate crises has produced calls for substantially expanding biodiversity protection. The draft post-2020 Global Biodiversity Framework includes a goal to conserve at least 30% of land and sea by 2030 through representative and well-connected protected areas, a goal endorsed domestically by the United States and many other countries, and proposed as part of the Global Biodiversity Framework, which is under consideration in the Convention on Biological Diversity.

A key focus area under dialogue two should be the management of marine protected areas (MPAs), which provide important socio-economic benefits in coastal communities and beyond. This focus should include an exploration of the role of technology in MPA science and management, as well as using MPAs as case studies for downscaling regional and global data, science integration, and climate change adaptation. The dialogue should also encourage the development, strengthening, and expansion of regional MPA networks and sister site partnerships to advance ocean science and management of shared or connected marine ecosystems.

Dialogue two should also highlight and explore that the conservation of marine, coastal, and freshwater ecosystems and sustainable fisheries management improve livelihoods and food security, increase the resilience of people and ecosystems to climate impacts, and promote maritime security, including countering illegal, unreported, and unregulated (IUU) fishing.

Finally, to improve biodiversity outcomes and management decisions, we need quantitative data on marine biodiversity and its distribution. This requires leveraging and resourcing a framework to expand collection and use of biodiversity information - such as the partnership among the Marine Biodiversity Observing Network (MBON); the Global Ocean Observing System (GOOS) Biology and Ecosystem Panel; and the Ocean Biodiversity Information System (OBIS). It also requires a focused effort to prioritize taxa and habitats relevant to management, identify gaps in knowledge and protection, and facilitate strategic expansion of protection - all priorities of the United States and global partners active in the Marine Life 2030.

Status and trends in the United States

The United States developed in 2021 a scientific framework to provide a quantitative assessment of U.S. marine biodiversity. The U.S. marine biodiversity assessment reveals that less than a quarter of observed marine species in U.S. waters are in fully protected areas and identifies priorities for where and how to expand the United States' MPA network. These findings are consistent with findings from the MBON, GOOS Biology and Ecosystem Panel, and the OBIS, which are working in partnership to address significant gaps in information about the status, variability, and diversity of marine life. Biodiversity coverage by MPAs varies substantially among U.S. regions and taxa, with the Pacific Islands closest to meeting conservation goals, while the five Alaskan ecoregions lag farthest behind. Few U.S. regions achieve successful biodiversity protection as defined by internationally accepted network criteria of the Convention on Biological Diversity.

Challenges and opportunities

U.S. marine biodiversity assessment

The U.S. marine biodiversity assessment improves on previous analyses of MPAs based on area under protection and exposes previously unappreciated geographic and taxonomic gaps in biodiversity knowledge and protection. These gaps highlight key areas for strategic investment and prioritization of both exploration and management interventions, including the establishment of new MPAs.

The U.S. marine biodiversity assessment builds on progress by U.S. MBON partners, which was achieved through significant U.S. government investments since 2014. It also builds on the progress of a global partnership and consortium led by MBON, GOOS and OBIS, which has worked with a broad range of global research and resource management partners to build communities around: expanded collection of biodiversity information to fill critical gaps for science and management, best practices and methods for data collection and sharing, coordinated efforts to increase capacity building and information exchange, and activities to advance citizen science and use of new technologies in areas where biodiversity information is critically needed

In the United States, results of the U.S. marine biodiversity assessment are now under review for incorporation into management by several U.S. federal agencies, and for inclusion in the Conservation and Stewardship Atlas proposed by President Biden's *America the Beautiful* initiative. The assessment framework developed for this initiative in the United States was designed by international expert consensus to be flexible and to use existing data. As such, it provides a model for parallel assessments in other regions and use cases.

Improving MPA Siting

In order to better fill existing gaps and to assist Member States with scaling up ocean action based on science and innovation, there is a strong need to develop broadly accepted quantitative criteria for size adequacy of MPAs, which could and should be based on larval dispersal ranges of major organisms. It is likely that few current MPAs are adequate to protect marine populations, suggesting many MPAs would be more effective if expanded. To ensure viable marine life populations in a changing climate, protected area networks should also strive for connectivity by establishing new MPAs in between existing MPAs that are isolated in space. In addition, strategically protecting recognized and important breeding and feeding areas for seabirds and mammals provides key opportunities for expanding national and global conservation networks by prioritizing species of conservation concern and key elements of their food webs such as forage fishes and plankton.

Improving Ocean Monitoring and MPA Understanding

Documentation and monitoring of biodiversity in oceanic waters severely lags behind that of coastal ecosystems. In particular, pathogens and invasive species can pose dire threats to biodiversity and people, yet there are no databases of marine pathogen distribution, hindering assessment. In addition, assessing the viability of MPA networks affected by climate change requires more and better projections and a greatly expanded understanding of species' future distributions, including of new species entering and disappearing from national waters.

Natural and Nature-Based Infrastructure

The International Natural Nature-Based Features (NNBF) for Flood Risk Management Guidelines (The Guidelines) are a multi-agency international effort, led by the U.S. Army Corps of Engineers, to develop guidelines on the use of natural and nature-based features for flood risk management. This effort was motivated by the need for a comprehensive guide that draws directly on the growing body of knowledge and experience from around the world to inform the process of conceptualizing, planning, designing, engineering, and operating NNBF. The Guidelines emphasize the role of nature-based solutions and natural infrastructure (e.g., beaches, dunes, islands, marshes) as an alternative to conventional hardened infrastructure for the purpose of flood and coastal storm risk reduction, and represent the international state of the science on conceptualizing, planning, designing, engineering, implementing and maintaining NNBF. The Guidelines are meant to provide end-users with instructions on using NNBF to improve infrastructure resilience, aligning with the goal to manage and conserve coastal and marine ecosystems and resources and maintain healthy and resilient ecosystems. The Guidelines equip decision-makers, project planners and practitioners with solutions that reduce flood and storm risks to communities through use of NNBF.

Strategic Approach to Scale Up Ocean Action

Opportunities to scale up ocean action based on science and innovation could follow the model of the U.S. Agency for International Development, which employs several strategic approaches to strengthen marine protected areas and sustainable fisheries management, specifically:

- *Promote Decentralized Co-management*: Implement strategies that share management rights and responsibilities between governments and small-scale fishers, referred to as co-management.
- *Strengthen Policy Frameworks*: Support policies, laws, and precedents that enable effective management, supportive regulatory environments, and the political will to enact changes.
- *Build Organizational Capacity*: Strengthen the capacity of civil society, resource user groups, and the public sector.
- *Promote Conservation Enterprises and Creating Alternative Livelihoods*: Promote conservation enterprises and businesses that generate economic and social benefits while helping to meet conservation outcomes.
- *Build Constituencies*: Build transparent relationships over time and increase the capacity of constituencies to advocate for marine conservation and sustainable fisheries management.
- *Improve Science and Information Capacities*: Use scientific and traditional knowledge to improve resource governance and promote evidence-based learning approaches.
- *Increase Traceability and Transparency*: Expand traceability and transparency in seafood supply chains to counter IUU fishing. Traceability is the ability to track the movement of seafood from its source to its end use. This practice can help expose illegal practices and create transparent supply chains that support marine sustainability and human rights.

Existing partnerships

Marine Biodiversity Observation Network (MBON)

The MBON is working to characterize, map and assess marine biodiversity, understand baselines and predict impacts of a changing environment on habitats and species, and engage in associated

capacity building efforts to expand capability to all nations, including small island developing States and least developed countries. The MBON is a part of the U.S. National Oceanographic Partnership Program (NOPP) where value is gained by working together through partnerships in ocean science.

International Coral Reef Initiative (ICRI)
ICRI is an informal partnership between Nations and organizations which strives to preserve coral reefs and related ecosystems around the world, and for which the United States is chair. Although ICRI is an informal group whose decisions are not binding on its members, its actions have been pivotal in continuing to highlight globally the importance of coral reefs and related ecosystems to environmental sustainability, food security, and social and cultural wellbeing. The work of ICRI is regularly acknowledged in United Nations documents, highlighting ICRI's important cooperation, collaboration, and advocacy role within the international arena. The United States is the current host of ICRI, co-chaired by the Department of State and the National Oceanic and Atmospheric Administration (NOAA). As co-chair, the United States has authored and endorsed the ICRI Plan of Action which will steer this body's work for the next three years.

Blue Carbon
A key developing issue area is coastal blue carbon ecosystems and their linkages to adaptation, mitigation, and finance. Through a partnership between the U.S. Department of State and NOAA, the United States is working with countries to integrate coastal wetlands into their National Greenhouse Gas Inventories and reflect this carbon-related service of coastal wetlands in their coastal resilience and ecosystem management strategies. In addition, the Smithsonian's Coastal Carbon Network hosts an open-access clearinghouse of curated data and analysis resources on coastal wetland 'blue' carbon stocks.

Possible areas for new partnerships
Co-management Approaches
The development of co-management approaches, including ecological and social MPA networks, are an effective way to protect and conserve priority areas in a changing ocean. In particular, this approach should consider how science, innovation, and information sharing with local stakeholders can support the creation of regional MPA networks and how the development, strengthening, and expansion of regional MPA networks and sister site partnerships can advance ocean science and management of connected marine ecosystems. There are strong opportunities to bring industry and indigenous stakeholders worldwide into partnerships that advance goals in global ocean conservation and associated biological knowledge delivery, which will be key to long-term success to conserve our ocean. These include the MBON (under the Group on Earth Observations Biodiversity Observation Network), the GOOS, the Partnership for Observation of the Global Ocean, the Smithsonian Institution's Marine Global Earth Observatory (MarineGEO) network and Marine Invasions program, the Deep Ocean Observing Strategy, the World Registry of Marine Species, the Scientific Committee for Oceanic Research, and others. There are also newly developing opportunities through the UN Ocean Decade, notably Marine Life 2030.

Financing
Another possible area for new partnerships is engaging with the private sector to increase financial flows for nature-based solutions for climate, which could include activities that

manage, protect, conserve, and restore marine and coastal ecosystems for adaptation, mitigation, and other human well-being goals. This could include establishing more "blue carbon" finance projects focused on mangrove conservation, as well as projects focused on other aquatic ecosystems of emerging blue carbon interest, such as seagrasses, coral reefs, and deep-sea habitats.

Conclusions and recommendations

The U.S. marine biodiversity assessment within U.S. waters improves on previous analyses of MPA coverage based solely on area under protection and exposes previously unappreciated geographic and taxonomic gaps in biodiversity knowledge and protection. These gaps highlight key areas for strategic investment and prioritization of both exploration and management interventions, including establishment of new MPAs. The assessment framework can be used in many other areas and provides a foundation for more strategic assessment of marine biodiversity to support management. Addressing the identified gaps with standardized monitoring and modeling will greatly strengthen decision-making around spatial management of marine resources, and help achieve conservation of 30% of ocean waters strategically and cost-effectively.

Key questions for the dialogue at the 2022 UN Ocean Conference

- What are the frontiers for implementing ecosystem-based management to sustain biodiversity in the many places where the ocean sustains other uses such as fishing and wind farms?
- Aquaculture will play a key role in food security and the sustainable future of the ocean. How can we utilize marine aquaculture as an important tool in restoration and conservation efforts in both a productive and safe way for wild species and ecosystems?
- Many areas do not meet the accepted definition of Marine Protected Area but are nevertheless important conservation assets, i.e. Other Effective Conservation Measures (OECMs). Can we develop agreed, standardized criteria for identifying and organizing information on OECMs?

Theme 3: Minimizing and addressing ocean acidification, deoxygenation and ocean warming

The ocean absorbs about 30% of the carbon dioxide (CO2) released into the atmosphere each year due to human activities, leading to ocean acidification. Ocean acidification entails changes in the ocean's carbonate chemistry, which can have detrimental effects on marine organisms, such as reducing the ability of reef-building corals and shelled mollusks to calcify. Direct consequences for marine life can propagate through the food web and affect ocean-related services and uses, including food security from fisheries and aquaculture, livelihoods, transportation, coastal protection, tourism, and cultural heritage.

In order to effectively address these issues, dialogue three should focus on the need to continue to improve our understanding of the rate and scope of deoxygenation, ocean acidification, and ocean warming. But beyond this, a key focus area under this dialogue should be addressing the causes of ocean acidification, deoxygenation, and ocean warming. This dialogue should also recognize the need to reach net-zero greenhouse gas emissions no later than 2050 to confront the climate crisis and the impacts of greenhouse gas pollution to the ocean.

In addition to highlighting the Global Ocean Acidification Observing Network (GOA-ON), dialogue three should address the impacts that these changes have not only at the global level, but also at local and regional levels.

Status and trends

Atmospheric concentration of CO2 has increased from 280 to over 400 parts per million since the Industrial Revolution. Ocean warming is occurring around the globe and the ocean has absorbed more than 90% of the anthropogenic heat gained by the planet. This increasing reservoir of heat contributes to sea level rise, marine heat waves, coral bleaching, and melting of ocean-terminating glaciers and ice sheets around Greenland and Antarctica. Some of the fastest warming ocean regions in the world are in the United States, particularly the Gulf of Maine and waters surrounding Alaska. Specifically, the temperature of the Northeast U.S. coastal ocean is increasing faster than most other regions of the world, with the Gulf of Maine warming faster than 99% of all other areas. This rapid warming threatens our ocean and its resources, notably economically important fishing and aquaculture industries.

Challenges and opportunities

Marine Protected Areas: Sentinel Sites

Marine Protected Areas (MPAs) can be sentinel sites to track environmental change and climate change impacts in order to help us better understand climate impacts. Sentinel sites are areas in coastal and marine environments that have the operational capacity for intensive study and sustained observations to detect and understand changes in the ecosystems they represent. Grouping sites together in a sentinel network provides a broad understanding of ecosystem conditions at specific temporal and spatial scales that are relevant to science and management priorities. Sustained observations of indicators of impending change within ecosystems may allow for effective control or mitigation through management action.

A fully functioning sentinel monitoring program consists of a continuum of activities that include observing, applied research, modeling and predictions, data analysis and visualization, information sharing, support for management decisions, and education and outreach. These monitoring programs help us understand and track ecosystems and their integrity, and provide early warnings of change.

The United States has a UN Decade of Ocean Science program on "MPAs as sentinel sites for ocean conservation, science and literacy" that is open for international partnerships. This program looks to understand climate impacts affecting the oceans; promote research on MPA uses and socioeconomic benefits to coastal communities; develop initiatives to promote ocean literacy; and support national and international initiatives to establish networks of MPAs.

Deoxygenation

The world's oceans are experiencing deoxygenation both in open and coastal oceans. Open ocean deoxygenation is mainly a result of increasing temperatures, while coastal ocean deoxygenation is a consequence of nutrient run off, increasing temperatures, and changing circulation patterns.

The U.S. National Oceanic and Atmospheric Administration (NOAA) has a Coastal Hypoxia Research Program (CHRP) program entirely focused on understanding the drivers of and impacts from low oxygen CHRP is a competitive research program focused on advancing the understanding, detection, prediction, control, mitigation, and response to hypoxia events in coastal areas. The overall goal is to improve the ability of resource managers to effectively prevent or reduce the ecological and economic impacts of hypoxia. The program does not currently have any international partners, but research results are available to the public.

The U.S. government also funds experts leading the Global Ocean Oxygen Network – an international network of experts focused on tracking oxygen content across the world's oceans.

Blue Carbon Capture

The ocean can play a key role in mitigating climate change by serving to capture carbon in "blue sinks." In addition to the many conservation benefits, MPAs can provide long term protection for "blue carbon" habitats such as salt marsh, seagrasses, mangroves, and kelp forests that store significant amounts of carbon and can potentially contribute to local ocean acidification mitigation. In addition, macroalgal aquaculture should be further developed to explore its potential as a tool for carbon capture, as a biofuel, and its ability to mitigate acidification and deoxygenation impacts.

Impacts on Fisheries and Aquaculture

Fisheries, including important U.S. fisheries, such as Dungeness crab, Atlantic sea scallop, Atlantic surf clam, and finfish dependent on coral reefs as habitat, may be vulnerable to ocean acidification. The rapidly expanding U.S. shellfish aquaculture (e.g., oysters, clams, mussels) sector is also at-risk from ocean acidification. Globally, aquaculture production will be critical in ensuring a resilient aquatic food supply in the face of environmental change. Aquaculture systems and methods can often provide control of environmental conditions and culture organisms can be adapted to changing conditions through methods such as selective breeding.

In order to effectively address these issues, there is a need to continue to improve our understanding of the rate and scope of deoxygenation, ocean acidification, and ocean warming and their impacts on fisheries and aquaculture. This information will also support a better understanding and characterization of these changes and their impacts on marine ecosystems, sea level rise, sea ice, and coastal resiliency. The U.S. government is investing millions of research dollars to study the impacts of rising ocean temperatures on fisheries, protected species, primary productivity, aquaculture, and other living marine resources. Critical outputs from this research include products developed for fisheries managers who must adapt to changing life history patterns and distributions of their stocks.

Communities rely on these resources for food security, livelihoods, and economic opportunity and management, conservation, and restoration of marine resources is vital to sustainable development. In particular, understanding how ocean acidification and ocean warming affect marine resources (e.g., coral reefs and fisheries) enables adaptation and builds the resilience of these ecosystems and the communities that depend on them. For example:

- U.S. Agency for International Development (USAID) Southern Africa regional mission's Reef Rescuers Project (2011 – 2019) focused on restoring damaged coral reefs in the Seychelles to increase their resilience and reduce the vulnerability of coastal communities to storms, floods and sea level rise.
- Through a small grant in the Caribbean, USAID partnered with the Centro de Estudios Costero Marinos/Fundación Dominicana de Estudios Marinos to establish a wet lab for the adaptive management of coral reef restoration in the southeastern Dominican Republic through a trained body of community technicians and volunteers. The purpose of this project was to support a conservation effort in the Dominican Republic's Southeastern Reefs Marine Sanctuary by reducing threats to coral reefs - such as thermal stress, pollution, sedimentation, coastal development, overfishing, sea level rise, and lack of community capacity to enforce fishing and tourism regulations – and enhancing their resilience to adapt to their changing environment.

Existing partnerships

World Ocean Database, hosted by the United States

The United States – through NOAA and its international partners – is observing and tracking ocean temperatures globally using its long-term observing data collection efforts from Argo, moorings, and ship-based estimates of ocean temperatures and ocean heat content. NOAA's long-term data is housed in NOAA's National Centers for Environmental Information (NCEI). NOAA is working with the International Oceanographic Data and Information Exchange (IODE) program of the Intergovernmental Oceanographic Commission (IOC) under the UN Decade of Ocean Science to further enhance the World Ocean Database, hosted at NCEI, which will bring together discoverable, publicly accessible, adaptable, and comprehensive global oceanographic data of known quality in a publicly accessible cloud environment. With very limited exceptions (e.g. proprietary data from fishing vessels) all NOAA data archived at NCEI is available on a full and open basis at no cost to the user. There can be a cost if the user is requesting data certified for use in a legal setting; however, in that instance they are paying for the certification not the data itself.

Global Ocean Acidification Observing Network (GOA-ON)
The GOA-ON is a collaborative international network designed to detect and understand the drivers of and ecosystem responses to ocean acidification. GOA-ON consists of over 800 members from 105 countries. The GOA-ON has nine regional hubs around the world: Arctic, North America, Latin America and Caribbean (LAOCA), Northeast Atlantic, Mediterranean, Africa, Southeast Asia, Western Pacific, and Pacific Islands and Territories (PI-TOA). GOA-ON provides mentorship (through its Pier2Peer program) and capacity-building opportunities to scientists in low-income countries and hosts a Data Portal that centralizes existing ocean acidification observing data.

The United States is a strong supporter of the GOA-ON and has provided scientific capacity support to numerous Pacific Island nations to monitor ocean acidification and study the biological responses to it. The U.S. Government together with GOA-ON, the IOC of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Ocean Acidification International Coordination Center (OA-ICC) of the International Atomic Energy Agency (IAEA), The Ocean Foundation (TOF), and the Swedish International Development Agency, has enhanced regional capacity for observing ocean acidification by distributing low-cost kits (GOA-ON in a box) of ocean acidification observation equipment to scientists in Fiji, Papua New Guinea, Samoa, Tuvalu, Vanuatu, Tokelau, and Palau. Recipients of the kits received multiple hands-on training sessions from leaders in the field and were paired with senior scientists as mentors to guide the establishment of long-term research programs in their countries. Most recently, this partnership supported the establishment of an "Ocean Acidification Regional Training Center" in Fiji, to be run by The Pacific Community (SPC), the University of the South Pacific (USP), the University of Otago, and the National Institute of Water and Atmospheric Research (NIWA). This center will provide training on ocean acidification and support ocean acidification equipment maintenance throughout the region.

GOA-ON's UN Decade of Ocean Science for Sustainable Development endorsed program "Ocean Acidification Research for Sustainability (OARS)" will build on the work of GOA-ON to foster the development of the science of ocean acidification including its impacts on marine life and sustainability of marine ecosystems in estuarine-coastal-open ocean environments. The programme will address the SDG target 14.3 "Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels". The OARS programme aims to provide systematic evidence of the impacts of ocean acidification on the sustainability of marine ecosystems, enhance ocean acidification capacity, increase observations of ocean chemistry changes, enhance the communication to policy makers and communities by providing the information needed to mitigate and adapt to ocean acidification and to facilitate the development and evaluation of strategies to offset future impacts.

NOAA's Ocean Acidification Program (OAP)
NOAA's Ocean Acidification Program (OAP) coordinates six coastal acidification networks (CANs) domestically: Alaska, California, Gulf of Mexico, Southeast, Mid-Atlantic, and Northeast. These CANs provide leadership, coordinate ocean acidification activities within their region, organize to establish ocean acidification priorities, and identify knowledge gaps within their region in collaboration with interested parties. It is important to capture information about coastal acidification, including local changes in water chemistry from land-based freshwater

river inputs and excess nutrient run-off (e.g., nitrogen and organic carbon). This information is also necessary for better understanding and characterizing these changes and their impacts on marine ecosystems, sea level rise, sea ice, and coastal resiliency. In addition, coastal habitat restoration (such as mangroves, salt marshes, and seagrass beds) is an important nature-based solution for adaptation and carbon sequestration.

OAP will support ocean acidification research in the Pacific Islands region through the OAP Pacific Islands Masters Fellowship. The fellowship will support students conducting research, in pursuit of a Master's degree, related to ocean acidification in the Pacific Islands region to help fill a critical gap in capacity for ocean acidification research and monitoring in the region. The grants will prioritize researchers from or research in the Federated States of Micronesia, Fiji, Kiribati, Maldives, Marshall Islands, Nauru, Palau, Philippines, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, and Vietnam. In addition to providing funding, this program provides the opportunity for early career researchers in the Pacific Islands region to join existing communities of practice and ongoing programming (e.g., training at the Pacific Islands Ocean Acidification Regional Training Hub in Suva, Fiji).

Possible areas for new partnerships

Ocean Acidification in the Caribbean Task Team

In keeping momentum from the IOC Assembly in Summer 2021, and the accepted IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE) Position Paper, there is a great need to strengthen capacities to monitor, mitigate, and adapt to ocean acidification and its impacts on coral reefs, as well as other important ecosystems, in contribution to the UN Decade for Ocean Science for Sustainable Development and UN Sustainable Development Goal Target 14.3. Therefore, the NOAA OAP and the NOAA Office of International Activities have established an "Ocean Acidification in the Caribbean Task Team" to help initiate an ocean acidification Community of Practice (CoP) in the region. The CoP will help tie together various intergovernmental bodies, researchers, and administrators around the challenges of ocean acidification and its impacts on ecosystem health and restoration. This CoP will help facilitate information and technology sharing across the Caribbean region through activities such as webinars, hands-on trainings, and engagement with the broader GOA-ON community.

Key questions for the dialogue at the 2022 UN Ocean Conference (300 words)

- How can we collaborate to scale up protection and restoration of blue carbon ecosystems, which provide climate resilience, carbon storage, and biodiversity benefits?
- How can MPAs advance climate resilience, carbon storage, biodiversity protection, and sustainable livelihoods?

Theme 4: Making fisheries sustainable and providing access for small-scale artisanal fisheries to marine resources and markets

Introduction

Fisheries and aquaculture play an important role in food security – providing half the world with a significant amount of animal protein intake – and their role in food and nutrition security should be a major focus of this dialogue. This discussion should highlight the value of science and innovation in supporting sustainable fisheries management, including in supporting fisheries stock assessments, as well as consider best practices in addressing data poor and unassessed fish stocks. Another key area that should be highlighted under this dialogue is ecosystem-based approaches to fisheries management. These approaches protect essential habitats, reduce the use of destructive fishing gears, and promote collaborative processes for decision-making. These approaches are effective in optimizing the stocks of fish available for sustainable harvest. In addition, the dialogue could explore ecological and social science on interactions between fisheries and marine protected areas (MPAs), as well as advancing the equitable use of ocean resources by empowering and protecting the access rights of small-scale and artisanal resource users. Finally, this dialogue provides an opportunity to consider how sustainable fisheries management and aquaculture can advance Sustainable Development Goals 2 (zero hunger) as well as 14 (life below water).

Status and trends

Three out of every seven people depend on fish as a primary source of protein, and fish products are the most widely traded food commodity in the world. Furthermore, small-scale fisheries employ more than 90 percent of the world's capture fisheries fishers and fish workers, half of whom are women, and contribute about half of global fish catch yet are often overlooked in decision-making processes. Fisheries and aquaculture are critical components of economic, social, and cultural livelihoods for millions of people around the world, and therefore should be central to this dialogue.

Wild-caught fisheries account for over 80 percent of fish production by weight in Africa, the Americas, Europe, and Oceania and 58 percent of fish production by weight in Asia, excluding China[1]. Aquaculture produces the remainder (FAO, 2020a). The fisheries sector, including all associated post-harvest activities such as fish processing and marketing, provides employment for an estimated 260 million people in marine fisheries (Teh and Sumaila, 2013) and 25 million in inland fisheries (Funge-Smith and Bennett, 2019). The FAO estimates that women comprise approximately 15% of the workforce involved in harvesting fisheries and aquaculture – but they fill the majority of the post-harvest jobs in the sector.

The UN Food and Agriculture Organization (FAO) reported that, in 2018, about 88% (or over 156 million tonnes) of total fish production was utilized for direct human consumption. 52% of fish used for human consumption was produced from aquaculture, and aquaculture will continue to play an increasingly important role in food security and human nutrition.

Challenges and opportunities

Combating IUU Fishing

[1] China produces over half of farmed fish globally each year.

Key to supporting sustainable fisheries is combating, deterring, and eliminating illegal, unreported, and unregulated (IUU) fishing. IUU fishing threatens economic growth, food security, and ocean ecosystems around the world by undermining sustainable fisheries and the livelihood of law-abiding fishers and communities that depend on them. New and innovative tools for monitoring, control and surveillance (MCS) can support efforts to combat IUU fishing, including by sharing information through initiatives such as the UN FAO Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels (Global Record)--the first global, publicly accessible database of fishing vessels. If all flag States participate, the Global Record and other innovative tools can help to enable enforcement authorities around the world to verify the identity and history of fishing vessels seeking access to ports.

The Global Record and other innovative MCS tools can also support implementation of other instruments to combat IUU fishing, especially the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA). Promoting and supporting the implementation of the PSMA worldwide will result in reducing the commercial viability of IUU fishing by identifying the ports authorized to receive foreign fishing vessels and ensuring that those ports are scrutinizing the incoming vessels for suspicious IUU fishing activity. Increased inspections and denial of port services (or port entry) to known IUU fishing vessels, will increase financial and logistical pressure on those engaged in IUU fishing.

Another major focus of the PSMA is information exchange and enhanced coordination of enforcement among Parties, as well as among the UN FAO and relevant regional fisheries management organizations. New technologies play an important role in developing an information exchange mechanism for PSMA Parties to access information quickly and efficiently, and to share pertinent information, while ensuring adequate protection for law-enforcement sensitive information. The increased information sharing called for by the PSMA, combined with other international initiatives to combat IUU fishing, will increase the data available on vessels engaged in IUU fishing or IUU fishing-related activities, preventing IUU fishers from taking advantage of weak points.

Fisheries Management

This discussion should also highlight the value of science and innovation in supporting sustainable fisheries management, including to support fisheries stock assessments, as well as a dissemination of decision support tools to foster the development of management solutions in data-limited fisheries. The National Oceanic and Atmospheric Administration's (NOAA) "FishPath" program specializes in these scenarios and is actively being implemented in many parts of the globe.

Open access management arrangements, limited livelihood alternatives, and competition with industrial (sometimes foreign) fleets all can lead to overharvesting, often with destructive gear, and are key challenges for developing States that should be addressed throughout this dialogue.

Small-Scale and Artisanal Fisheries

We note dialogue four currently lacks a substantive connection to supporting the communities that depend upon these resources. 2022 is the International Year of Artisanal Fisheries and Aquaculture (IYAFA) and will highlight the contributions to human well-being, healthy food

systems, and poverty eradication that responsible and sustainable use of fisheries and aquaculture resources provide for small-scale artisanal fishers, fish farmers and fish workers. In addition, the United States is committed to the role of sustainable fisheries and aquaculture in food security, gender and social inclusion, and equity and environmental justice.

This dialogue should encourage making these considerations a priority in efforts to support fishing communities and, more broadly, in ocean resource management. Key opportunity areas include increasing government accountability for co-management through support for fisher organizations, civil society, and academia; empowering fisherfolk in co-management, particularly women and youth; and increasing transparency in licensing, catch, and enforcement.

Existing partnerships

Capacity Building

The United States, through the U.S. Agency for International Development (USAID), invests approximately $40 million across 20 countries to promote sustainable fisheries and marine conservation in Africa, Asia, Latin America and the Caribbean and the Pacific. Working with civil society, academia, fisher organizations, and governments our programs include:

- Supporting decentralized co-management
- Strengthening constituency voice and organization
- Enhancing policy frameworks
- Improving science and information capacities
- Building organizational capacities
- Promoting conservation enterprises and supplemental livelihoods
- Increasing traceability and transparency

The majority of USAID's activities support governments, civil society organizations, and the private sector in strengthening the capacities, constituencies, and information needed to implement science-based, collaborative fisheries management. This work includes addressing the underlying drivers of unsustainable behavior by shifting incentives and responding to the heavy dependence on natural resources in countries where USAID invests. These programs also support improved fisheries policies and regulations that prioritize sustainability, enhanced and equitable enforcement of regulatory frameworks, empowerment of women and other marginalized groups engaged in the sector, loan guarantees to catalyze investments in legal and sustainable fisheries, and comprehensive seafood traceability. Examples of these partnerships include:

- USAID/Malawi's fisheries program supports Beach Village Committees and fishery extension officers around Lake Malawi in developing and implementing local fisheries management plans.
- USAID/Ghana's fisheries program facilitated the adoption of a policy that empowers fishing communities and organizations to have greater influence and responsibility in fisheries management.
- USAID's Regional Development Mission for Asia is working to strengthen the capacity of leading multinational organizations to provide stronger science and policy leadership within Southeast Asia and the Pacific.

- USAID/Indonesia's fisheries program supported the development of a Fair Trade certified fishery that provides market incentives for achieving ecological and social sustainability goals.
- USAID/Philippines' fisheries program enhanced leadership of resource users and stakeholders for marine biodiversity and built consensus to implement customized, resilient ecosystem approaches to fisheries management.
- USAID/Central America-Mexico Regional Coastal Biodiversity Project trained and hired coastal community members as "citizen scientists" to collect biophysical data.
- USAID/Tanzania, in partnership with the Seafood Alliance for Legality and Traceability, is piloting the use of traceability to increase seafood value for artisanal fishers.

Traceability
New science and technology can also help to promote seafood traceability – the ability to track the movement of seafood through supply chains – for food safety, sustainability, and legality. For instance, electronic catch documentation and traceability systems can be designed to address economic and ecological goals. One example is USAID's Seafood Alliance for Legality and Traceability (SALT), a global alliance for knowledge exchange and action to promote legal and sustainable fisheries through improved transparency in seafood supply chains. SALT is a global community of governments, the seafood industry, and non-governmental organizations working together to share ideas and collaborate on solutions for legal and sustainable seafood with a particular focus on traceability. SALT is relevant to both small-scale and large-scale fisheries, striving to enhance sustainable and legal value chains, trade, and fisheries management.

HMS Fishery Management Engagement and Development for Small Scale Fishermen in the U.S. Caribbean (Puerto Rico and USVI)
Over a multi-year period the National Marine Fisheries Service conducted unprecedented outreach and constituent engagement in the U.S. Caribbean, which precipitated greater constructive public involvement to provide new opportunities for tuna and swordfish fishermen. Tailored management measures that reflected small-scale Caribbean Highly Migratory Species (HMS) fishing practices targeting tuna and swordfish, collected better catch and effort data, provided for sustainably-managed fisheries, and met international obligations.

The Commercial Caribbean Small Boat (CCSB) permit provides new access to HMS fisheries and increases economic opportunity throughout the Caribbean. Fisheries data are being collected in a manner compatible with local Caribbean markets supplying mainly local consumption and tourism. This kind of permitting and fisheries data collection program will improve data upon which fisheries management decisions are made and can be replicated in other areas.

Possible areas for new partnerships
Governments must work together – with each other, with fishing communities, with civil society, with philanthropists, and with concerned citizens around the world – to detect and deter IUU fishing and ensure the sustainability of our ocean. To do this most effectively, we are creating new partnerships, leveraging new technologies, and finding new ways to share our knowledge and experiences.

Transparency and Information Sharing

Promoting increased transparency, open source information, and data-sharing will help us understand the full picture of the IUU fishing problem, both on the high seas and in exclusive economic zones. A key component of this will be looking beyond traditional government-to-government partnerships to find new ways to use the wealth of information already being collected and analyzed about what is happening at sea. With improved transparency, we can create and apply a force-multiplying approach to put our shared data to use to address the true drivers of IUU fishing and other maritime challenges, such as forced labor, safety at sea, and mitigating and adapting to climate disruptions.

Global Fishing Watch

For example, the United States Southern Command (SOUTHCOM) recently partnered with the international nonprofit organization Global Fishing Watch, to amplify SOUTHCOM's ability to detect and target IUU fishing. Through this partnership, Global Fishing Watch will provide public vessel tracking data and open-source maritime domain awareness tools to support SOUTHCOM's on-the-water efforts in Latin America and the Caribbean.

Conclusions and recommendations

Conserving and managing shared fisheries resources requires international cooperation. Investing in sustainable fisheries management, curbing overexploitation and illegal, unreported, and unregulated (IUU) fishing, and reducing food loss and waste and improving transparency and traceability in fisheries can help us protect and sustainably manage these key resources and the role aquatic foods play in ensuring a world with zero hunger.

Key questions for the dialogue at the 2022 UN Ocean Conference

- How can we work together to promote the role of fisheries and aquaculture in sustainable food systems and national food security and nutrition strategies?
- What steps can we take to increase regional maritime information sharing best practices?
- How can we better recognize the nutritional value of blue foods, which provide key nutrients?
- How can we work to minimize food loss and waste and discards in the seafood supply chain?
- How can we better prioritize addressing the specific challenges facing small-scale artisanal fishers, fish farmers and fish workers in efforts to support fishing communities and, more broadly, in ocean resource management?

Theme 5: Promoting and strengthening sustainable ocean-based economies, in particular for small island developing States and least developed countries

Dialogue five should consider how to create the elements of a sustainable ocean economy, such as sustainable ocean transport, sustainable ocean energy, sustainable ocean food, and sustainable ocean-based tourism, among other elements. It should also consider the creation of a "culture of resilience" that recognizes changing conditions and threats impact social and economic structures, critical lifelines, environmental sustainability, and the provision of ecosystem services. Sustaining ocean-based economies, particularly for small island developing States (SIDS), is dependent on achieving resilience in relation to ocean-based hazards such as tsunamis. This dialogue should also emphasize the value of indigenous voices and support intercultural collaboration by building relationships and capacity through partnership programs. Lastly, the dialogue should include discussion of the role sustainable finance plays in growing the sustainable blue economy.

Challenges and opportunities

Focus should be given to supporting capacity building that ensures global collection of and access to publicly available marine biodiversity and ecosystem information, towards conservation and sustainable use of living coastal and marine resources. In particular, vulnerable small island and big ocean nations can be buffered against the ramifications of climate change through international support that provides enhanced capacity building, data sharing, and collaborative research and economic ventures. SIDS are highly vulnerable to the impacts of climate variability and change. Promoting and strengthening SIDS and ocean-based economies will require: 1) climate-related information at appropriate scales to support regional or local level adaptation actions; 2) improved access to climate financing for the implementation of mitigation and adaptation actions; and 3) management, restoration and conservation actions that address multiple stressors (e.g. pollution, over extraction, extreme weather events) to improve the health and resilience of coastal and marine resources and the communities and economies that depend on them. Also, opportunities and challenges for scaling up ocean-based renewable energy such as offshore wind, solar, tidal, wave, and thermal, as well as transitioning to zero-carbon shipping, all of which support sustainable blue economic growth should be explored in this dialogue.

The United States, through the U.S. Agency for International Development (USAID), partners with SIDS to mitigate disaster risk, reduce emissions, build resilience, and support adaptation in the face of a changing climate. USAID humanitarian assistance programming strengthens the capacity of coastal communities and countries to reduce risks induced by coastal hazards such as cyclones, storm surge, and high tides. Efforts include nature-based solutions that reduce exposure and vulnerability to coastal hazards and build capacity for preparedness, as well as science, technology, and data to increase the ability to monitor and forecast ocean hazards such as storm surge. USAID also works with partner countries on all aspects of the energy sector to develop safe, reliable access to clean and efficient energy that drives development and addresses climate mitigation goals.

Finally, this dialogue should include discussion of support for capacity building to ensure global collection and access to marine biodiversity and ecosystem information, towards conservation and sustainable use of living coastal and marine resources as well as support for aquaculture development to provide economic, environmental, social, and food security benefits for SIDS communities.

Existing partnerships

Tsunami Ready Program

The Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Tsunami Ready Program is designed to deliver advanced tsunami planning and preparedness capabilities to all vulnerable Coastal and Island States including SIDS. There are currently two dozen communities designated as Tsunami Ready in the Pacific, Caribbean, and Indian Ocean areas, and this number needs to be increased significantly in order to consider a global readiness.

USAID Pacific Climate Ready

In addition, the USAID Pacific Climate Ready project supports Pacific Island countries in becoming more environmentally and disaster resilient to protect the lives and livelihoods of their peoples. The project works with government partners and other stakeholders to draft and implement policies to achieve adaptation goals; access larger amounts of financing from international adaptation funds; and improve the skills and systems within each country to better manage and monitor adaptation projects.

USAID's Caribbean Energy Initiative (CEI)

USAID's CEI focuses on building energy sector resilience across the region, in recognition of the critical role that a steady, reliable energy supply plays in the daily economy of the recovery. This program supports reducing electricity prices; increasing service quality; and enhancing the ability of electricity systems in the Caribbean to withstand shocks.

Rising Voices

The Rising Voices program facilitates intercultural approaches to understanding and adapting to extreme weather and climate events, climate variability, and climate change. The university-based program works to advance climate science by partnering Indigenous knowledge systems with the Earth sciences to improve responses to extreme weather and climate change. The program brings Indigenous and other scientific professionals, tribal and community leaders, environmental and communication experts, students, educators, and artists from across the United States, including Alaska, Hawaii, the Pacific and Caribbean Islands, and around the world, to assess critical community needs and to pursue joint research aimed at developing optimal plans for community action towards sustainability. Rising Voices acknowledges the inherent value of Indigenous knowledge systems and Indigenous science, adaptive practices and processes, honoring them equally with Earth sciences. At its core, Rising Voices aims to advance science through collaborations that bring Indigenous and Earth (atmospheric, social, biological, ecological) sciences into partnership, support adaptive and resilient communities through sharing scientific capacity, and provide opportunities for Indigenous students and early career scientists through scientific and community mentoring. Further, Rising Voices helps Western-trained scientists expand their observational skills, research paradigms, capacity to

apply and translate findings, and ultimately improve their science. The program - through an annual workshop series, knowledge exchanges, trainings, and an active listserv - has facilitated the creation of new and continued intercultural adaptation partnerships based on respect, justice, equality, and reciprocity that address our changing climate.

Pacific Risk Management 'Ohana (PRiMO)
The Pacific Risk Management 'Ohana (PRiMO) is a U.S.-based regional community of practice that provides open forums to facilitate coordination across sectors and governments, foster cooperation, and catalyze collaboration in adapting to the impacts of climate change. Established in 2004, PRiMO engages several U.S. federal agencies, other regional institutions, non-U.S. agencies and partners, and academic institutions through its biennial forum in Hawaii and its interim working sessions in U.S. Pacific Islands. PRiMO has extensive experience engaging non-U.S. flag island leaders, policy and technical experts, and members of indigneous communities in open dialogues on regional climate and disaster issues. The foundation of PRiMO's regional engagement is its respect for and incorporation of the customs and traditions represented in the islands into its principles of operation, identification of islands' challenges and solutions, and mutual learning. In addition, PRiMO has partnered with a broad range of Indigenous island experts to provide leadership across the spectrum of disaster risk reduction and resilience through local, regional, and federal partnerships.

U.S. Partnership with Island States
The United States also has a suite of whole-of-government initiatives including, the Local2030 Islands Network, Small and Less Populous Island Economies Initiative (SALPIE), and Presidential Emergency Plan for Adaptation and Resilience (PREPARE). These include:

- Local2030 Islands Network: In partnership with the Department of State, the National Oceanic and Atmospheric Administration (NOAA) is working with the Local2030 Islands Network to advance sustainable development and climate resilience in the Pacific and the Caribbean through Communities of Practice, public-private partnerships, and technical collaboration.
- Global Ocean Acidification Observing Network (GOA-ON): GOA-ON is a collaborative international network to detect and understand the drivers of ocean acidification in estuarine-coastal-open ocean environments. The network provides key input to communities, industry, and governments seeking to develop action plans, best practices, and mitigation or adaptation strategies to address ocean acidification impacts, including impacts on coral reef ecosystems and fisheries. Through GOA-ON, NOAA is providing $1.2M in funding to support monitoring and assessment efforts of Pacific Island Countries.
- Risk Management Capacity Building: Building on work done in Hawaii and the U.S.-Affiliated Pacific Islands, the NOAA Pacific Regional Integrated Sciences and Assessments (RISA) team is supporting risk management and resilience by partnering with the Hawaii Local2030 Hub and providing support for an integrated online dashboard for sub-regional decision support and tracking of climate change in crosscutting regional strategies.
- NOAA One Health: Through NOAA's One Health Working Group, NOAA Regional Climate Services, and other partners, NOAA conducts research, data provision, training and capacity building for the development of climate-based early warning systems for

dengue and other mosquito borne diseases, water-related illness, extreme heat, marine animal health, and migration to reduce health and related environmental and security risks. Currently, NOAA is supporting research and engagement related to climate, health, and migration in the Republic of the Marshall Islands and heatwaves in Puerto Rico.

Possible areas for new partnerships

Through the PREPARE initiative, NOAA is seeking to establish a GOA-ON hub and to fund an ocean acidification regional training center in the Caribbean region. The hub would bring together experts from Spanish, English, French, Dutch, and Portuguese speaking nations of the region to deliver capacity building and support ocean-based economies.

Key questions for the dialogue at the 2022 UN Ocean Conference (300 words)

- How can we collaborate to scale up ocean-based renewable energy—including offshore wind and solar as well as other ocean energy such as tidal, wave, and thermal—to create jobs and address the climate crisis?
- How can we collaborate to spur the transition to zero-carbon shipping to minimize environmental impacts, reduce greenhouse gas pollution, and create sustainable ocean economies?
- What role can financial institutions play in promoting a sustainable blue economy?

Theme 6: Increasing scientific knowledge and developing research capacity and transfer of marine technology

Dialogue six should provide a cross-cutting opportunity to explore the critical role of ocean and marine weather, and environment and biodiversity observations and predictions in understanding many of the eight dialogues. Increasing scientific knowledge and research capacity is critical for improving our understanding of the ocean's role in weather, climate, and extreme events as well as changes in marine ecosystems and living resources. This research also informs the development of products and services that can help communities prepare and adapt to changes. This dialogue should recognize and encourage the development of increased scientific knowledge and research capacity.

Ocean observations are the backbone of ocean, weather, and climate forecasts and understanding changes to marine ecosystems. Ocean mapping and observations also inform our understanding and characterization of marine ecosystems and provide critical information for coastal resiliency and preparedness. The United States has a number of activities in ocean mapping, environment and biodiversity observing, ocean acidification programs, seabed mapping, tsunami warning systems, ocean literacy initiatives, and other topics that strongly support the global research community.

This dialogue should also support capacity building to ensure global collection and access to actionable information on marine biodiversity and ecosystem information to fill critical monitoring gaps, along with complementary physical and biogeochemical observations, towards sustainable use and development of living coastal and marine resources.

Finally, this dialogue should provide plans to incorporate Indigenous and traditional ecological knowledge into the scientific body of knowledge that is accessed and used by the international community.

Status and trends

Living Marine Resources science is on the cusp of a major transition to more advanced observing technologies, including: "Omics", acoustics, electronic monitoring, new sensor technologies, and various forecast models. Additionally, advances from Silicon Valley, including computer vision, machine learning, and robotics, are increasingly being used to automate and scale up our observations. Some countries are already beginning to implement these technologies in augmentation of their existing management paradigm. This dialogue could note advancing use of new technologies for biology and ecosystem observing, including environmental DNA, artificial intelligence/machine learning, optical and acoustic technologies, and robotics. As these technologies continue to develop and advance, so too do their data standards. It is important to emphasize the need for global-level cooperation and coordination in these standards, and sustained resourcing of data management, to ensure data interoperability and increase accessibility to least developed countries.

Challenges and opportunities

Strengthening Ocean Observation and Mapping

Strengthening ocean observing and mapping capabilities, coverage, and technologies is critical for meeting increasing demands for fit-for-purpose oceanographic data. This is especially true for observations of the ocean's diverse life, which is more challenging and therefore well behind advances in climate and environmental monitoring. New technologies such as autonomous systems are an example of observing advancements that will allow for more efficient data collection and enable access to remote regions (and depths) where information is limited. Uncrewed surface and subsurface maritime vehicles require a collective member approach to the governance and ownership of the vehicles and the data in the open ocean. Outfitting such vehicles with compact, cutting-edge instruments for automated collection and in situ processing of environmental DNA, and sensor array platforms presents a potential revolution in ocean biological knowledge that is now well within reach.

Increasing accurate and real-time ocean and maritime atmosphere observations is critical to properly initializing and operating the new Earth Systems Prediction Capabilities. Tightly coupled earth system models require tightly coupled ocean/maritime atmospheric observations to accurately numerically initialize and predict the global, regional, and local environment.

Successfully addressing the eight Conference dialogues during the upcoming UN Decade on Ocean Science will require the implementation of an operational and fully integrated earth system prediction capability, one that incorporates coupled ocean/air/sea ice models, with appropriate biological parameters, at various spatial and temporal scales. Enhancing our prediction capabilities would help achieve the "A Predicted Ocean" outcome of the Ocean Decade, the goal of which is to increase our understanding of changing ocean conditions so that we can better respond to them.

U.S. Initiatives

The United States, through the National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone (NOMEC), supports dialogue six by setting goals to acquire bathymetric and other mapping and characterization data throughout the U.S. exclusive economic zone. NOMEC also places emphasis on promoting and advancing new technologies to make ocean mapping, exploration, and characterization more efficient and effective, including enabling technologies in uncrewed systems, high bandwidth communications, machine learning and artificial intelligence. Developing new sciences and technologies for ocean mapping and exploration can in turn increase global capabilities.

National Oceanic and Atmospheric Administration (NOAA) activities also advance our "Science and Technology for America's Oceans: A Decadal Vision" strategy published by the Subcommittee on Ocean Science and Technology of the Office of Science and Technology Policy in November 2018. In addition, U.S. national programs in global ocean science and coordination with complementary global efforts stimulate an international ocean research enterprise in support of the Intergovernmental Oceanographic Commission (IOC).

The U.S. Ocean Biocode aims to create a global, digital library of marine species that links DNA sequences to species names, knowledge of organisms, and their ecologically important traits. DNA reference libraries can currently identify only <25% of animal species in environmental profiles. It is therefore essential to build out the digital library of ocean biodiversity via a

strategic program of field sampling that links expert-identified voucher specimens with DNA sequences and images. The Smithsonian in the United States has the experience, expertise, resources, and partners to unlock quickly moving innovative technologies and deliver on the Ocean Biocode. This critical link to natural history knowledge can scale automated biodiversity censusing across all stakeholder communities, from local to national and from citizen science activities to industrial applications, to provide an unprecedented map of ocean life across all domains.

The Coral Sentinel Program, led by the Smithsonian, is working on developing an automated, scalable platform using remote sensing, low-cost autonomous robots, sensor arrays including automated DNA sampling and processing, and stereo camera systems for 3D mapping of benthic ecosystems from the surface to mesophotic depths. The program will work with local coastal communities to co-design the system to collect the data critical for improving their "Blue Economies" and will use machine learning to provide the data rapidly in a format easily accessible to the community stakeholders.

Aquaculture
Marine aquaculture is poised for rapid growth in the United States and in other countries worldwide. Novel systems and methods with highly impactful production projections are continually being deployed and have the potential to contribute significantly to global seafood supply. This dialogue should support development of technologies that ensure industry growth is environmentally, economically, and socially sustainable.

NOAA Global Ocean Carbon Network
The ocean regulates climate by absorbing carbon dioxide (CO2) from the atmosphere thus slowing the rate of climate change. The NOAA Global Ocean Carbon Network aims to monitor the uptake and storage of CO2 by the ocean to understand how this important sink for anthropogenic CO2 is functioning; how ocean carbon storage might change in the future; and how we can best anticipate, mitigate, and adapt to potential future changes. Tracking the sources and sinks of CO2 is also necessary to assess progress towards achieving the long-term goals of the Paris Agreement. However, this Network is not yet capable of monitoring carbon sinks with sufficient fidelity to inform carbon policy decisions or answer key questions about future capacity of the ocean to store carbon. A multi-national research and development effort to address key questions and more carefully monitor ocean carbon is required, including in coastal wetlands and nearshore ecosystems which store a disproportionate fraction of ocean carbon for their area.

Ocean Literacy
Ocean literacy is also critical to dialogue six and the overall UN Ocean Conference. The United States played an early and key role in catalyzing a global ocean literacy movement. National Geographic, NOAA, the Lawrence Hall of Science, the College of Exploration, the U.S. National Marine Educators Association (NMEA), and others pioneered the development of the U.S. essential principles and fundamental concepts of ocean literacy, catalyzing similar campaigns and initiatives globally. This cooperative work, along with that of NMEA and its members, and the Smithsonian Institution's National Museum of Natural History and Ocean Portal, has been a catalyst for the ocean literacy movement around the globe, inspiring international colleagues to

establish their own ocean literacy guides and their own marine education organizations such as the European Marine Science Educators Association and the Asia Marine Science Educators Association.

Existing partnerships

The United States is the leading contributor to the development of the knowledge, tools, and capabilities to observe the global ocean. We provide our global ocean data to all, free of charge, and work with partners through various national, regional, and global programs, including the IOC Global Ocean Observing System (GOOS), the World Meteorological Organization's Integrated Global Observing System (WIGOS), the Group on Earth Observations (GEO), and the Ocean Biodiversity Information System (OBIS). There is a need for better information sharing of ocean data to ensure that those data are accessible, useful, and relevant to the communities and decision-makers that need it the most. NOAA hosts the U.S. Secretariat office of the GEO Blue Planet Initiative which seeks to exploit synergies among the many ocean and coastal observing programs; enhance the timeliness, quality and range of services delivered to a variety of users; and increase awareness of societal benefits of ocean observations. Multiple U.S. projects by a number of federal agencies, including NOAA and Smithonian, come under this initiative including those on marine litter, Sargassum, invasive species, eutrophication, and more. NOAA also serves in several international leadership roles across GOOS and the global Marine Biodiversity Observation Network (affiliated with GEO). Through these fora and with the global Ocean Best Practices Repository, the United States supports standards and best practices for biology and ecosystem data collection and sharing. This dialogue could promote standardized management and access to biological and ecosystem data, including but not limited to efforts of the OBIS, biodiversity data rescue activities, and implementation of GOOS' biology and ecosystem Essential Ocean Variables.

Global Operational Surface Ocean Carbon Dioxide Network

A new international effort to establish a Global Operational Surface Ocean Carbon Dioxide Network was presented at the 2021 UN Climate Change Conference (COP26). This network will integrate established (e.g. Ship of Opportunity) and proposed national and regional surface ocean carbon dioxide research and monitoring efforts into a global framework, enabling countries to track the changes in the global ocean uptake of CO2 over time. This network will track sources and sinks of CO2 to assess progress towards achieving the long-term goals of the Paris Agreement. In addition, it will produce high-value products, such as authoritative, observation-based annual updates of ocean carbon uptake as part of the sustainable development goal 14.3.1. This is critical for decision making and policy assessments related to the role of the ocean in mitigating climate change and related societal and economic impacts, including the impacts of CO2 uptake and related ocean acidification on marine ecosystem health.

Global Tsunami Warning System

The Global Tsunami Warning System is based on earthquake analysis, but there are also significant risks to coastal communities vulnerable to either near-field or non-earthquake source tsunamis. An ocean-based tsunami detection, measurement, and forecast capability has transformed the way emergency managers prepare for and manage tsunami threats. However, there are still gaps in the ocean observing network that require a collective member approach to mitigate risks and transform the way emergency managers manage tsunami threats. Networks

for tsunami detection similar to the Ground-Based Global Navigation Satellite System and/or industry ocean-bottom fiber-optic cable groups would be transformative in terms of providing the sensing needed to quickly detect, measure, and inform coastal communities for the full range of tsunami threats. Investment in building capacity, especially in small island developing States and least developed countries (LDCs), to be able to build and operate effective tsunami national warning systems,support observational networks, and establish community readiness will save lives and reduce the number of affected people and economic losses. Every leap in national resilience translates to savings in aid-funded post-disaster response and recovery assistance.

Possible areas for new partnerships

Human communities rely on biodiversity for sustenance and cultural benefits, yet biodiversity is the missing link in marine observing and there are critical gaps in our understanding. This dialogue should encourage new partnerships to advance the Marine Life 2030 Decade Programme and the global Marine Biodiversity Observation Network, and the broad, committed global consortium behind those efforts.

Conclusions and recommendations

Ocean biological observing systems are likely to rapidly adopt emerging automation and novel data streams across omic, acoustic, and optical domains during this coming decade. The ability to translate these records into meaningful and actionable information will depend on enhanced reference libraries and improved training sets to interpret patterns in our changing oceans. These data need to be operationalized and linked to highly contextualized, well-calibrated physical and chemical measurements in order to allow predictive modeling and future planning for sustainable use, early warning and mitigation, and assessment of policy actions.

Key questions for the dialogue at the 2022 UN Ocean Conference (300 words)

- How can we best develop collaborations and dialogue between providers of marine scientific knowledge and stakeholders, particularly in the developing world and indigenous communities, who need that knowledge?

Theme 7: Enhancing the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United Nations Convention on the Law of the Sea

Emphasizing the universal and unified character of the Law of the Sea Convention, and reaffirming that the Convention sets out the legal framework within which all activities in the oceans and seas must be carried out.

Recognizing the importance of conserving and sustainably using biodiversity and the need to understand human impacts on the marine environment and living marine resources, the paper could explore further integration of science and data in ocean governance.

Theme 8: Leveraging interlinkages between Sustainable Development Goal 14 and other Goals towards the implementation of the 2030 Agenda

The United States recognizes the 2030 Agenda and its Sustainable Development Goals as the primary global framework for sustainable development that can help countries work toward global peace and prosperity. We applaud the call for shared responsibility in the Agenda and emphasize that all countries have a role to play in achieving its vision. The Agenda is a common rallying point for the international community and the private sector to share both the burdens and the opportunities inherent in addressing global development challenges. We strongly support the national responsibility stressed in the Agenda and the mobilization and effective use of domestic resources and strong partnerships with the private sector. The United States supports the 2030 Agenda as a framework for development and will continue to be a global leader in sustainable development through our policies, partnerships, innovations, and calls to action.

Blue foods or aquatic foods, the focus of Sustainable Development Goal 14: life below water, are essential components of sustainable food systems and critically important to livelihoods and achieving the universal food security and nutrition goals of Sustainable Development Goal 2. Aquatic foods include marine and freshwater fish, shellfish, aquatic plants, seaweed, and algae. Fish alone provide over 3.3 billion people globally with at least 20 percent of their average per-capita animal protein intake and are a good source of essential fatty acids and micronutrients (FAO, 2020; Bennett et al., 2018). Seven of the most nutrient dense sources of animal protein are aquatic foods, namely small pelagics, bivalves, large pelagics, aquatic mammals, salmonids, carps, and cephalopods (Golden, et al. 2021). The health benefits of eating fish include decreased risk of cardiovascular disease, improved maternal health during pregnancy and lactation, and improved cognitive and physical development during early childhood (FAO, 2020).

Aquatic foods can play a significant role in improving global nutrition and achieving the goal of zero hunger enshrined in Sustainable Development Goal 2. By increasing sustainable aquatic food production through financial investments, effective fisheries management, and aquaculture innovation, 166 million people worldwide could avoid undernutrition by 2030 (Golden et al. 2021).

Status and trends

While fish are critical for food security, many fisheries face significant and often converging threats from overexploitation (i.e. legal but unsustainable fishing, and illegal, unreported, and unregulated (IUU) fishing) and climate change, as well as habitat destruction; chemical, metal, nutrient, and plastic pollution; and invasive species. Inland fisheries also face blocked migration routes due to infrastructure and competing uses for fresh water (Stuchtey et al., 2020; Free et al., 2019; Funge-Smith and Bennett, 2019, IPBES, 2019). These threats drive declines in fish catches which subsequently undermine food security, nutrition, and livelihoods. For instance, an estimated 10 percent of the global population could face fatty acid and micronutrient deficiencies over the coming decades due to declines in marine fish catch (Golden et al., 2016). The World Bank also estimates that overexploitation and poor management of fisheries leads to a loss of about $83 billion annually in economic benefits (World Bank, 2017).

The solution to many of the threats facing fisheries is first and foremost sustainable fisheries management. When managed effectively, fisheries can not only maintain production but sustainably produce more fish, thus helping to achieve the U.S. Government's Global Food Security Strategy's three strategic objectives of poverty reduction, increased resilience, and improved nutrition outcomes. Remarkably, the High-Level Panel for a Sustainable Ocean Economy, an initiative supported by 14 countries[1] that account for nearly 40 percent of the world's coastlines, estimates that ocean-based food production could increase by up to six times current levels through a combination of sustainable fisheries management and responsible, sustainable finfish and bivalve aquaculture (Costello et al., 2020). Furthermore, every $1 invested in sustainably increasing ocean-based food production can yield up to $10 in benefits such as healthier diets, higher revenue for local communities, and lower greenhouse gas emissions (Konar and Ding, 2020; Stuchtey et al., 2020). Similarly, the UN Food and Agriculture Organization (FAO) notes that overfished marine fish stocks can be rebuilt through intensive fisheries management that decreases average fishing pressure and leads to increased stock biomass (FAO, 2020a). An analysis of 288 fish stocks found that rebuilding plans, international fishing agreements, and harvest control rules are among the most effective management actions to decrease overfishing and recover depleted fish populations (Melnychuk et al., 2021). Reforming fishing subsidies to direct resources away from enhancing fishing capacity and towards building institutional and technical capacity for sustainable fisheries management is another important action (Costello et al., 2020). With the human population projected to reach 10 billion by 2050, sustainably increasing ocean-based food production is critical to meeting food security and nutrition needs and may have a comparative advantage over terrestrial animal production systems in increasing animal protein production with less environmental and climate change impacts in certain contexts and geographies (Stuchtey et al., 2020; Costello et al., 2020).

In addition to promoting sustainable fisheries management, addressing food loss and waste in fisheries value chains can also improve food security. Fish are highly perishable and, without adequate care along the value chain, post-harvest spoilage, loss, and waste can take place, particularly in low-income countries with limited access to the technology needed to process, preserve, and transport fish. In fact, about 35 percent of the global fish harvest from fisheries and aquaculture is lost or wasted annually (FAO, 2020a). Investments in environmentally sound methods to process, package, preserve, and transport fish—such as the use of fuel-efficient technologies to smoke fish and develop cold chains—can decrease post-harvest loss and increase the quality and quantity of fish available for local communities (USAID, 2018a).

Challenges and opportunities

The U.S. Government's Global Food Security Strategy for 2023-2026 recognizes fisheries as a vital component of agriculture—along with aquaculture and land-based agricultural practices such as farming, forestry, and pastoralism—and supports promoting the sustainable management of fisheries as an important strategy for feeding a growing population while providing employment and income. Investments along fisheries value chains, including sustainably increasing fisheries productivity, are key to achieving the three GFSS objectives:

[1] Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau, and Portugal.

- Fisheries support **inclusive and sustainable agricultural-led economic growth**: Fish and fish products are among the most traded food commodities globally, with an export value estimated at $164 billion in 2018 (FAO, 2020a). In addition, small-scale fisheries—often located in rural areas with limited infrastructure, employment opportunities, and access to formal markets—support the livelihoods of 90 percent of people employed in fisheries (FAO, 2020a; Cohen et al., 2019). However, social and cultural norms that limit opportunities and participation, and persistent inequalities such as lack of access to finance, decreased decision-making authority, and gender-based violence, prevent the full participation of women, youth, Indigenous Peoples, and other marginalized groups in economic opportunities and leadership roles within the fisheries sector (USAID, 2018a; Siles et al., 2019, FAO, 2020a). Lack of sex- and age-disaggregated data on who participates in the sector further limits informed decision-making and evidence-based activity design (Siles et al., 2019). Efforts to empower marginalized communities are key to more equitable sharing of economic benefits from the fisheries sector and inclusive economic growth.
- Sustainably managed fisheries contribute to **strengthened resilience among people, communities, countries, and systems:** Fisheries, when managed well, contribute to community resilience by providing local sources of nutritious food, diversified livelihoods along the fisheries value chain, and income (FAO, 2020a). For many poor households that experience chronic food insecurity, fish provides high-quality food that is often more affordable than other animal source foods like red meat. Inland fisheries, which are often overlooked during fisheries-related policy discussions, are particularly critical to resilience for communities with limited access to ocean resources and for those located in isolated areas and near rivers, lakes, and other inland bodies of water (Funge-Smith and Bennett, 2019; FAO, 2020a). In addition, rice field fisheries - which involve the capture or harvest of wild aquatic species within the rice field ecosystem such as ponds and canals - support nutritional needs and livelihoods in a number of countries in the Lower Mekong, including Cambodia where rice field fishery catch provides 62% of household fish intake in the Tonle Sap region (Freed et al, 2020). Fisheries also provide fish to landless households that cannot produce crops and serve as a critical safety net when land-based food production is compromised due to climate change, as well as conflict and other shocks (Bennett et al., 2021).
- Fisheries contribute to **a well-nourished population, especially among women and children:** Protein from fish is generally more bioavailable than plant-based protein, with digestibility exceeding 90 percent (Kwasek et al., 2020). Fish are also a source of vital nutrients and micronutrients that are critical for diversified, healthy diets such as vitamins A, B, and D, minerals such as calcium, zinc, and iron, and polyunsaturated fatty acids. The nutrients in fish can help combat a range of health conditions such as childhood stunting and blindness, rickets, anemia, low birth weight, pregnancy complications, and cardiovascular disease (Funge-Smith and Bennett, 2019; Bennett et al., 2018). Infants of mothers who consume fish during pregnancy and breastfeeding have better health outcomes, such as physical and cognitive development, compared with infants whose mothers did not consume fish during these critical periods (Bennett et al., 2018). A recent global analysis highlights the potential for marine fisheries to improve nutrition for local communities. Researchers found that for 22 countries, predominantly in Asia and West Africa, 20 percent of their marine fish catches could meet the dietary requirement

for iron, calcium, and vitamin A for children under age five who live within 100 kilometers of the coast (Hicks et al. 2019; Pauly, 2019).

Finally, the Global Food Security Strategy highlights aquatic foods and the importance of improved natural resource management, including sustainable fisheries management, in ensuring the sustainability of food security investments throughout the strategy and in a cross-cutting intermediate result.

Existing partnerships

The U.S. Agency for International Development's (USAID) investments in marine conservation and sustainable fisheries, which total about $40 million annually in more than 20 countries, focus on increasing human well-being co-benefits, such as food security, through sustainable management along the value chain. Tailoring to the local context, USAID aims to strengthen resource governance, support participatory decision-making, recover degraded fish stocks through ecosystem-based management, empower women and other marginalized groups, improve the contributions of fisheries to local livelihoods and food security, combat IUU fishing and forced labor in fisheries, and promote transparency in fisheries licensing, fisheries agreements, and fisheries value chains (USAID, 2021a). The following programming examples span the diversity of USAID fisheries activities across the Feed the Future, biodiversity, and humanitarian assistance portfolios:

- ***Philippines Ecosystems Improved for Sustainable Fisheries (ECOFISH, 2012-2017):*** ECOFISH worked with local governments and the Philippines Department of Agriculture's Bureaus of Fisheries and Aquatic Resources to improve ecosystem-based fisheries management in eight marine key biodiversity areas and develop a variety of market-based initiatives to improve economic opportunities for small-scale fishers and support conservation enterprises. ECOFISH achievements include a 24 percent increase in fish biomass within select fisheries, a 12 percent increase in the number of people experiencing socio-economic benefits such as higher fish catch, incomes, and/or fish consumption in focal areas, and improved management of 1.8 million hectares of municipal marine waters. ECOFISH also worked with women to diversify their livelihoods by providing training to participate in the tourism industry and raise crabs using eco-friendly methods (USAID, 2017b). USAID's Fish Right program is building on these achievements by addressing biodiversity threats, improving marine ecosystem governance, and increasing fish biomass in Philippine waters (Coastal Resources Center, 2021).
- ***Senegal Collaborative Management for a Sustainable Fisheries Future (COMFISH, 2011-2016 and COMFISH Plus, 2017-2018) and Feed the Future Senegal Dekkal Geej (Restoring the Sea, 2019-2024):*** COMFISH supported the Government of Senegal's efforts to reform its fisheries sector by strengthening enabling conditions necessary for improved fisheries management, such as strategic generation and application of evidence and science, supporting ecosystem-based and adaptation-based management of the country's marine fisheries, and strengthening capacities at all levels of governance (ministry of fisheries, communities local organizations, research, etc.). The project enhanced the participation of small-scale fishers in the co-management process, worked with women fish processors to expand their role in the fisheries sector and increase their incomes, and improved hygiene and safety protocols for fish processing. It also

supported the completion of the first sector climate adaptation National Action Plan (USAID, 2015). Dekkal Geej is building on the accomplishments of COMFISH to strengthen constituent demand for and engagement in a more sustainable, accountable and equitable fisheries management system that builds on evidence-based decision-making, questions the current co-management model, and seeks to incentivize behavior and institutional change. Dekkal Geej will also strengthen community resilience and enhance food security and livelihoods by supporting the development of sustainable value chains. On the policy front, Dekkal Geej will roll out an agenda for strengthened policy formulation and implementation to support sustainable and equitable fisheries management and increase fisheries' contributions to Senegal's economic growth. (USAID, 2019a).

- ***Ghana Sustainable Fisheries Management Program (SFMP, 2014-2021):*** SFMP focused on rebuilding declining marine fish stocks, particularly in small-scale fisheries that are crucial to local food security and livelihoods. SFMP achievements include the adoption of a new national fisheries co-management policy between the government and fisheries stakeholders, establishment of an annual closed season for small-scale and semi-industrial fleets to help fish stocks recover, the planting of over 8,000 mangrove seedlings in degraded areas, an increase in media engagement and reporting of fisheries-related issues, and the creation of the Fisher-to-Fisher Dialogue platform to facilitate discussions between Ghana's Fisheries Commission and its constituencies to develop consensus for fish stock recovery (USAID, 2020a). SFMP also implemented actions to combat child labor and trafficking in the fisheries sector as well as an innovative program designed to prevent the spread of COVID-19 in fishing communities (USAID, 2021c).
- ***Feed the Future Innovation Lab for Fish (Fish Innovation Lab):*** The Fish Innovation Lab leverages the expertise of several U.S. universities and research institutions to improve nutrition, food security, and livelihoods by supporting aquaculture systems and sustainable fisheries in Feed the Future focal countries. A common theme among all Fish Innovation Lab activities is to promote positive behavior change that improves nutrition and food security among vulnerable groups and sustains fish stocks for future generations. For example, Kenya's SecureFish collected data on coastal communities, including anthropometric measures of young children, details of children's diets, distribution and access to fish by season and location, and specific characteristics of the value chains for different fish species, to help inform nutritional, environmental, and socioeconomic interventions that improve human welfare and strengthen fisheries management among coastal communities in Kenya (USAID, 2021b).
- ***Indonesia Sustainable Ecosystems Advanced (SEA, 2016-2021):*** SEA partnered with the Ministry of Marine Affairs (MMA) and local governments to improve fisheries management and marine conservation. SEA worked with the MMA and the governments of Makulu, North Maluku, and West Papua provinces to strengthen small-scale fisheries management, increase enforcement of maritime laws, protect globally significant marine ecosystems, and improve marine spatial planning. SEA also engaged coastal communities and fisheries stakeholders, including women and youth, to actively participate in protecting the marine resources they depend on - in particular, the activity increased the participation of women as "SEA champions" of sustainable fisheries management and marine conservation from 2 to 16 percent over the course of the activity. With support from SEA, the Government of Indonesia created 14 new marine

protected areas that cover 1.6 million hectares and local governments strengthened marine spatial plans for an area covering approximately 17 million hectares. In over half of the marine protected areas established by SEA's support, fish biomass either remained stable or increased; in addition, fishers' incomes improved, and 350 fishers received almost $80,000 in funds in 2020 to invest in sustainable initiatives within their communities. SEA also worked with fishers to establish certification programs for sustainable fisheries in project sites, supported local communities in developing sustainable tourism enterprises, and engaged the private sector including hoteliers and dive operators to support sustainable marine tourism (USAID, 2021d).

- ***Enhanced Coastal Fisheries in Bangladesh (ECOFISH, 2014-2019):*** ECOFISH was jointly implemented with the Department of Fisheries to support fishing communities reliant on the Megna River ecosystem, with a particular focus on establishing co-management of hilsa shad (*Tenualosa ilisha*) sanctuaries. ECOFISH's strategies included generating high quality evidence on local fisheries to aid management decisions, engaging fisheries stakeholders through co-management committees, providing training and inputs to diversify livelihoods of fishing households, and improving policies to support fisheries management. ECOFISH successes include a 31 percent increase in the maximum sustainable yield of hilsa shad from 526,000 metric tons per year in 2016 to 690,000 metric tons per year in 2019, representing a significant increase in the quantity of fish available to local communities. The average weight of hilsa increased from 510 to 915 grams over the first two years of the activity, with fisher household incomes increasing by up to 65 percent. ECOFISH also established 148 women-led community savings groups, 575 hilsa conservation groups, and 133 village-level fisheries management committees. ECOFISH provided training to 20,800 fishers (30 percent women) on strategies to manage the natural resource base more sustainably and conserve biodiversity. To highlight women's participation in fisheries management, ECOFISH organized an annual Fishers Women Congress (USAID, 2020c)

Conclusions and recommendations

Investing in sustainable fisheries management, curbing overexploitation and IUU fishing, and reducing food loss and waste and improving transparency and traceability in fisheries value chains shows promise in preserving and strengthening the role that aquatic foods play in ensuring a world with zero hunger. The global community should work together to achieve these aims.

Key questions for the dialogue at the 2022 UN Ocean Conference (300 words)

- How can we work together to promote the role of blue foods in sustainable food systems and national food security and nutrition strategies?