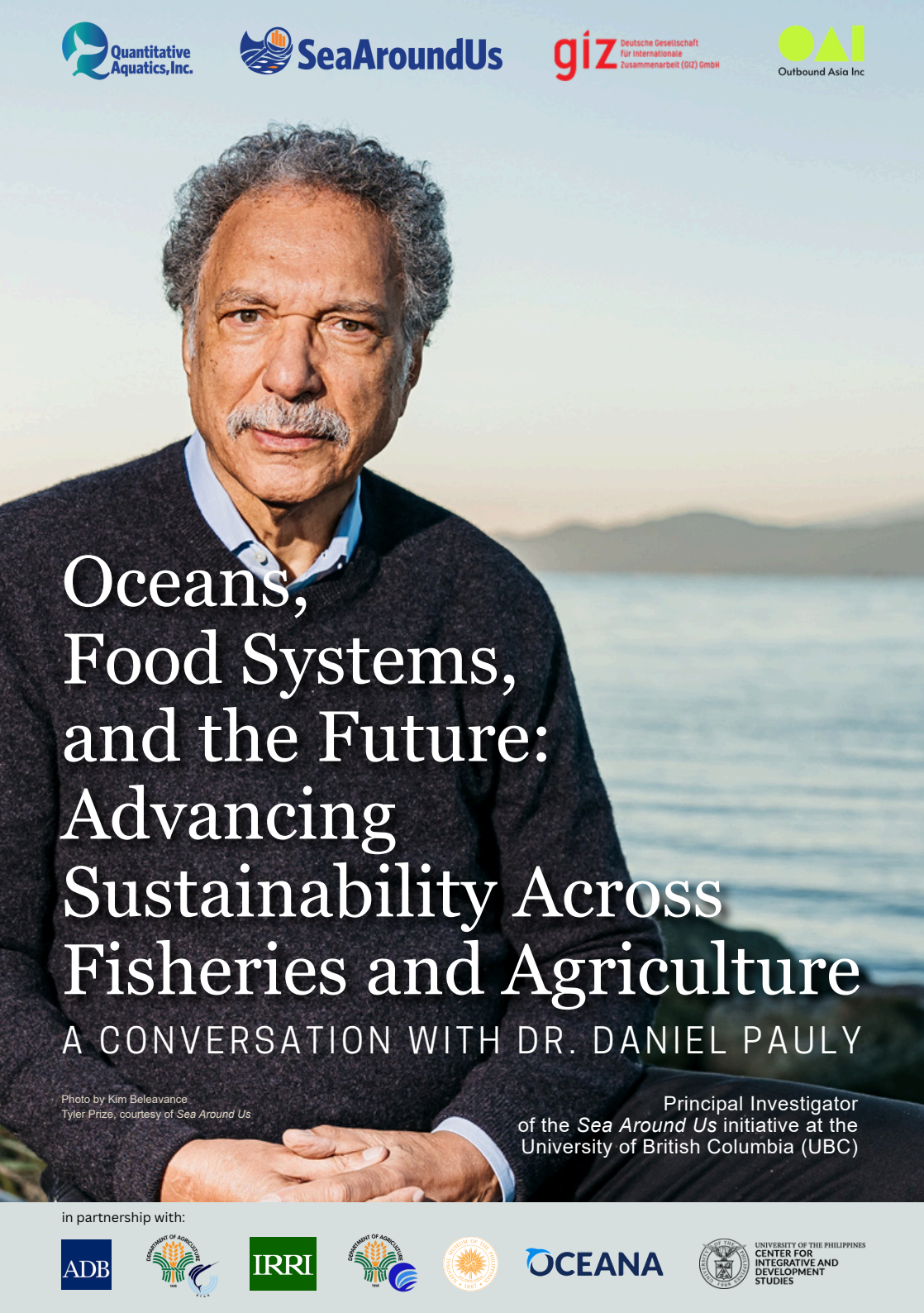


Oceans, Food Systems, and the Future: Advancing Sustainability Across Fisheries and Agriculture

A CONVERSATION WITH DR. DANIEL PAULY

Photo by Kim Beleavance
Tyler Prize, courtesy of *Sea Around Us*

Principal Investigator
of the *Sea Around Us* initiative at the
University of British Columbia (UBC)

in partnership with:

A SPECIAL LECTURE SERIES

Dr. Daniel Pauly has transformed the understanding and management of fisheries, marine ecosystems, and ocean conservation with his pioneering research. He demonstrates how science can inform policies and investments that protect aquatic resources, sustain livelihoods, and strengthen food security.

This lecture series coincides with significant milestones in his career, including the March 2026 publication*, 'Breathing Water in a Warming World', with J. Müller which examines how environmental stress and warming affect aquatic animals and ecosystems. It also anticipates a landmark global fisheries stock assessment initiative covering approximately 124 Exclusive Economic Zones (EEZs) from 1950 to 2022, led by the *Sea Around Us* and the Minderoo Foundation.

The Philippines holds particular significance in Dr. Pauly's career summing up approximately 15 years of work in the country. Thereafter, he established the *Sea Around Us* initiative at the University of British Columbia in 1999 with its unprecedented catch reconstruction program which has strengthened global fisheries data and informed fisheries governance, conservation, and policies addressing harmful subsidies and illegal, unreported, and unregulated (IUU) fishing.

The lecture series brings together development, research, government, academic, and civil society partners to explore the policy and investment implications of his work. Its insights call on everyone to take responsibility for preventing further harm to the aquatic environment, the life within it, and the life it sustains. While our impact may be devastating, it is largely reversible. The series also calls for a rethinking of fisheries development, particularly as industrial fishing, ocean warming, and deoxygenation threaten small-scale fisheries and coastal food security. Equally important is the recognition that herbivorous aquaculture generates a net increase in seafood production, whereas carnivorous fish farming consumes more fish than it produces. This distinction is as important as recognizing that farmers harvest what they produce, while fishers harvest what nature produces.

Initiated by Quantitative Aquatics, Inc. (Q-quatics), with Asian Development Bank (ADB), Bureau of Fisheries and Aquatic Resources (BFAR), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, International Rice Research Institute (IRRI), National Fisheries Research and Development Institute (NFRDI), National Museum of the Philippines (NMP), Oceana, *Sea Around Us* and University of the Philippines Center for Integrative and Development Studies (UP CIDS), the public lecture series runs from **24–26 November 2026**, bringing science, policy, and practice together to advance sustainable fisheries and aquatic ecosystems.

*https://www.sidestone.com/books/breathing-water-in-a-warming-world



NOVEMBER

24 TUE

The Forgiving Waters

In partnership with OCEANA Philippines and National Museum of the Philippines

Venue: Upper Courtyard, National Museum of Natural History, P. Burgos Dr., Rizal Park, Manila
Time: 9:00 AM - 12:00 NN

25 WED

Why the fish in the Philippines are getting smaller and mature at smaller sizes

In partnership with Bureau of Fisheries and Aquatic Resources (BFAR), National Fisheries Research and Development Institute (NFRDI), and University of the Philippines Center for Integrative and Development Studies (UP CIDS)

Venue: Lower Ground Floor, Ang Bahay ng Alumni, Magsaysay Avenue, University of the Philippines Diliman, Quezon City
Time: 9:00 AM - 12:00 NN

From ocean depletion to development risk

In partnership with Asian Development Bank (ADB)

Venue: Auditorium Hall 2, 6 ADB Avenue, Mandaluyong City
Time: 3:00 - 5:00 PM

26 THU

Agriculture and Fisheries: Commonalities and Differences

In partnership with International Rice Research Institute (IRRI)

Venue: DL Umali Hall A-C, IRRI, College, Los Baños, Laguna
Time: 2:00 - 4:00 PM



Among the partners in this series, the National Museum of the Philippines and Oceana are perhaps the organizations most accessible to the general public. This lecture places on civil society the responsibility for preventing further destruction of the aquatic environment and the life it sustains, complementing the role of scientists in demonstrating what needs to be done and how we can reverse the damage we have caused.



ABSTRACT

The Forgiving Waters

The title of this presentation was suggested to me without elaboration as to what this meant, but I immediately embraced it because indeed, the freshwater bodies and oceans of our planet are 'forgiving,' i.e., their ecosystem and biodiversity quickly recover from the injuries we are currently inflicting on them if we stop doing so. This is the very reason why it makes sense to fight for the environment, e.g., for the proper management of fisheries, or the establishment of effective marine protected areas (MPA). In fact, it is a great Filipino, Professor Angel Alcala who established, against much 'scientific' opposition, that MPA 'work' in the sense that closing a small fraction of a coral reef area leads to the larger, exploited fraction of that reef to recover its fish populations and become capable of sustaining higher catches. This, and similar experiences in various parts of the world, provide a solid base for related positive interventions. Sixty-six million years ago, an asteroid hit the Earth and annihilated most of its animal life. Humans also have a devastating impact on the Earth's biodiversity; however, our impact is slow and largely reversible. The job of scientists is to show what should and can be done and it is for the NGOs and Civil Society to make sure that it is done, in the Philippines and the World.



UNIVERSITY OF THE PHILIPPINES
CENTER FOR INTEGRATIVE AND DEVELOPMENT STUDIES

The partnership with Bureau of Fisheries and Aquatic Resources (BFAR), the National Fisheries Research and Development Institute (NFRDI), and the University of the Philippines Center for Integrative and Development Studies (UP CIDS) brings to this lecture series a strong technical focus, targeting fisheries management practitioners from government agencies and NGOs.

Understanding the Gill-Oxygen Limitation Theory (GOLT) can inform research priorities, fisheries policies, stock assessments, aquaculture practices, and climate adaptation strategies. It provides a scientific basis for anticipating how warming waters affect fish growth, reproduction, migration, and productivity. The knowledge shared is expected to strengthen evidence-based management, build institutional capacity, and support interventions that safeguard fisheries-dependent livelihoods and food security.



ABSTRACT

Why fish in the Philippines are getting smaller and mature at smaller sizes

There is less oxygen in the best aerated sea- or freshwater than on top of Mount Everest. Fish and other water-breathing ectotherms (WBE) deal with this through a number of adaptations shaped by physical and dimensional constraints. These constraints are the key components of the Gill-Oxygen Limitation Theory (GOLT), which will be presented, along with a book titled 'Breathing Water in a Warming World' co-authored by Johannes Müller of Leiden University, which emphasize the mechanisms regulating key aspects of the biology in fish and other WBE (i.e., their growth and its response to temperature, the timing of maturation, migrations, and others).

The GOLT's basic tenet is that the surface area of the gills or other respiratory surfaces of WBE cannot, as 2-dimensional structures, supply them with sufficient oxygen to keep up with the growth of their 3-dimensional bodies, and to compensate for the spontaneous denaturation of their bodies' proteins, which is extremely temperature sensitive. Notably, the unavoidable reduction of oxygen supply to the growing body of a WBE induces sexual maturation, and later a slowing and cessation of growth, all accompanied by an increase of physiological processes relying on glycolytic enzymes and a declining role of oxidative enzymes.

These processes, which are intensified by global warming, are all impacting fish in the marine and freshwater of the Philippines, which because of the high temperatures prevailing therein, are already close to their upper tolerance limits. This presentation will conclude with some suggestions for research – for example on fish pond aeration and information campaigns.





The Asian Development Bank (ADB) plays a vital role in advancing policies and investments that promote sustainable, inclusive, and climate-resilient fisheries and aquaculture across Asia and the Pacific.

This featured lecture with ADB highlights the importance of aligning development investments with long-term ecosystem health, food security, sustainable livelihoods, and equitable economic returns.

ABSTRACT

From Ocean Depletion to Development Risk

In contrast to agriculture, where investing in more inputs (fertilizer, irrigation, better seed, insecticides, etc.) increases production, fisheries do not deploy inputs that increase fish production because it is nature that 'produces' the fish, not the fisheries.

This essential difference between agriculture and fisheries as 'production systems' is the source of many misunderstandings concerning fisheries and their actual and potential roles in development.

Notably, subsidizing the construction and deployment of ever larger and more powerful fishing vessels, which many countries perceive as 'developing' their fisheries, usually leads small-scale fisheries to lose out to industrial fishing, while their overall resources base tends to decline.

This trend, which is occurring throughout the world – including in Southeast Asia – is worrisome, and, combined with the effects of ocean warming and deoxygenation, it suggests that fisheries globally are in deep trouble.

Aquaculture may help, but not if it consists of the farming of carnivorous fish – such as Norwegian salmon – because these fish must be fed with small fish which otherwise would be consumed directly. Indeed, this form of aquaculture is generating a worldwide rush on smaller fish that endangers the food security of coastal communities in many countries of the Global South. This is different for the farming of herbivorous fish, and bivalve such as clams and mussels, which still makes the bulk of aquaculture production, especially in Asia.

Overall, fisheries and aquaculture can fulfil a very positive role in economic developments, but they must be managed to achieve shared benefits. If not, they can and will contribute to the impoverishment of coastal populations, and of the seas.



IRRI International Rice Research Institute

The International Rice Research Institute (IRRI) partnership brings an important food systems perspective to this lecture series, highlighting the complementary roles of agriculture and fisheries in global food security and nutrition. The lecture challenges conventional measures of food production by distinguishing between agriculture, where inputs can increase yields, and fisheries, which depend on nature's capacity to replenish fish stocks. These distinctions have important implications for food policy, resource allocation, and investment priorities. The discussion offers opportunities for cross-sectoral learning and collaboration toward more sustainable, resilient, and nutrition-sensitive food systems that balance agricultural productivity with healthy aquatic ecosystems.



ABSTRACT

Agriculture and Fisheries: Commonalities and Differences

Both agriculture and fisheries (marine and freshwater) contribute to human food requirements, the former contributing the overwhelming bulk of the energy needed to power the activities of human bodies, and the latter much of the proteins and other nutrients required for good health. Also, agriculture shares with animal husbandry a vast number of processes and concerns, just like fisheries share processes and concerns with aquaculture.

Thus, at least in the latter case, to lump their 'production' into a single seafood category and present its ever-increasing tonnage as a sign that things are going well, as done by the Food and Agriculture Organization of the United Nation (FAO) is quite problematic.

First, in strong contrast to agriculture, where the size of the harvest is largely a positive function of the farmers' input (seeds, fertilizers, pesticides, irrigation, etc.), and thus can be called their 'production,' fishers, however skilled, do not 'produce' anything. Their catch cannot and should not be called a 'production.' It is Nature alone which 'produces' the fish that fishers catch.

This has enormous consequences for the management of fisheries, notably because fishing vessels are not an 'input' that can be deployed for increasing fish 'production.' One of these consequences is that subsiding fisheries, which redistribute fisheries catches, also, in the majority of cases, actually reduce their overall levels.

Similarly, aquaculture must be separated into its two basic forms: A: the farming of herbivorous animals (e.g., bivalve mollusks such as clams and oysters), which yields at net production of seafood, and B: the faming of carnivorous fish (notably Norwegian style salmon) which consumes far more fish than it produces.

Clarifying these concepts is required, because confusion is one of the reasons why we have such problems in fisheries, aquaculture and the food security of billions of people.



Photo by Kim Beleavance
Tyler Prize, courtesy of *Sea Around Us*

Daniel Pauly

Dr. Daniel Pauly is a globally recognized fisheries scientist and marine conservation expert whose research has changed understanding of fishing impacts on marine ecosystems, fisheries sustainability, and global food security. He is University Killam Professor at the University of British Columbia (UBC), Canada, its highest academic distinction, and Principal Investigator of the *Sea Around Us* initiative. Before joining UBC in 1994, he spent 15 years at the International Center for Living Aquatic Resources Management (ICLARM, now WorldFish) in the Philippines, holding senior scientific and management positions.

Dr. Pauly pioneered scientific tools and knowledge platforms underpinning fisheries research and management worldwide. He was a co-architect of FishBase, the world's largest online encyclopedia of fishes, also co-developer of Ecopath with Ecosim, a widely used ecosystem modeling framework. Since 1999, he has led the *Sea Around Us*, which reconstructs global fisheries catches and assesses their ecological and socioeconomic impacts, informing fisheries policy and marine conservation.

His contributions extend to global science-policy processes. He served as Coordinating Lead Author for the Millennium Ecosystem Assessment's marine systems work and contributed to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report. He has advised organizations including the World Bank, FAO, and UNESCO, served on Oceana's Board, and was a member of Science magazine's Advisory Board (2020–2023).

His international honors include the Tyler Prize for Environmental Achievement (2023), Chevalier de la Légion d'Honneur (2017), Nierenberg Prize (2012), Ramon Margalef Prize in Ecology (2008), Volvo Environment Prize (2006), and International Cosmos Prize (2005). He is a Fellow of the American Association for the Advancement of Science and the Royal Society of Canada. He holds eight honorary doctorates.

With over 1,000 scientific publications and 20 books, Dr. Pauly is among the world's most highly cited marine scientists.

https://www.seaaroundus.org/wp-content/uploads/2026/02/D.-Pauly-CV-updated-to-February-2026.pdf
d.pauly@oceans.ubc.ca

Quantitative Aquatics, Inc.

Founded in 2017 to address the lack of integrated, accessible, and permanently available aquatic biodiversity information systems to support better decisions. It stewards and advances FishBase, SeaLifeBase, and AquaMaps, providing free, scientifically validated information to 700,000 users monthly. Through these global public goods and collaborations with partners, Q-quatics supports research, fisheries management, conservation, policy, and the sustainable use of aquatic resources, translating scientific knowledge into practical solutions for aquatic biodiversity and ecosystem sustainability.

Q-quatics operates under the scientific guidance of the FishBase Consortium (FBC)* which was created in 2000 and who's mandate is to support the growth, sustainability and public accessibility of FishBase, SeaLifeBase, and Aquamaps.



*https://www.q-quatics.org/affiliated-projects/#fbc

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