

Blue Foods: Opportunities at the Intersection of Climate, Food, and Oceans

Introduction

Blue foods are a critical part of the global food system. They are the foundation of food security in coastal communities around the world and a vital source of nutrition for 3 billion people. They are also important to development – the blue food sector provides livelihoods for 800 million people and accounts for a larger share of global trade than all other food commodities combined. Blue foods will be even more important in the years ahead, as they offer a rich array of possibilities for providing healthy, sustainable diets to a world of ten billion people.

Given their importance, blue foods should be an integral part of any discussion about the future of food systems as a key priority for investments and action in food security and nutrition, adaptation and resilience, and reducing emissions. Yet blue foods are chronically consigned to the margins of the global agenda. Discussions of the future of food systems focus on agriculture, livestock, plant-based proteins and cell cultured products; blue foods are historically ignored in international and national discussions about current and future food production (and its impact on larger ecosystem changes).

Blue foods have long been at the heart of ocean conservation efforts, as mismanaged fisheries are a major stress on ocean ecosystems and biodiversity. Fisheries are inherently regenerative; if we manage them well, we can restore biodiversity and increase production by 20%, nearly closing the gap of what is needed for seafood production, with huge potential benefits for food security, nutrition, climate, and livelihoods and economic development. Aquaculture, the fastest growing food sector, also has an important role to play, and investment is urgently needed to ensure that this growth is both socially responsible and environmentally sustainable. Overall, the carbon footprint of producing blue foods is one of the lowest of all animal sources of protein and there is room for further emissions reductions. Neither fisheries management nor aquaculture development, however, is getting the government attention it needs to ensure sustainability and achieve its full potential.

The “blue food agenda” was conceived to help mobilize the action needed to address these challenges by illuminating the importance of blue foods to creating healthy, sustainable food systems, specifically to elevate blue foods in the priorities of the governments, funders, and others. Ultimately, fisheries and aquaculture should be fully integrated into the mainstream of food system priorities and policymaking – a priority not just for Fisheries Ministers but for Health Ministers, Environment Ministers, Finance Ministers, and Prime Ministers.

Overview of Blue Foods

The [Blue Food Assessment](#) (BFA), led by Stanford and Stockholm University, brought together 100 scientists from around the world to develop the scientific foundation for bringing blue foods into food system policy. The BFA defines “blue foods” to include all fish, invertebrates, algae, and aquatic plants

that are caught or cultivated for food from marine and freshwater environments. It identifies several characteristics that shape the potential of blue foods to contribute to food system priorities.

- **Extraordinarily diverse:** There are more than 2,500 species of blue foods. They are produced through a wide variety of methods, with diverse impacts and value chains. The result of this diversity is that blue foods offer an extraordinary array of possibilities - varying in the nutrients they offer, their ecological footprint, and the roles they can play in food systems.
- **Rich in nutrients:** Blue foods are not only good source of protein, but also are rich in an array of micronutrients – including Vitamin A and B12, omega-3s, iron, zinc, calcium, and others – that are essential for healthy development. In fact, most categories of blue foods (mollusks, small pelagics, large pelagics, etc.) are richer in this set of micronutrients than any terrestrial meats (See Figures 1 and 2 below).
- **Vital for livelihoods and economic growth:** Large-scale industrial producers are an important source of blue foods for global markets. However, small-scale actors produce, process, and distribute most of the blue food destined for human consumption. They also provide 90% of the jobs, supporting 800 million livelihoods in the blue food sector. Exports of blue foods by producers large and small provide \$38 billion in annual revenue for developing countries (FAO 2020), more than all agricultural commodities combined.
- **A lighter footprint:** Overall, the carbon footprint of blue foods is lower than nearly all animal source protein produced on land (see Figure 3). However, blue foods vary widely in the impacts of production, with some blue food systems incurring higher emissions and ecological impacts than others (see Figure 4).

Blue Foods and the UN Sustainable Development Goals

Protecting and expanding blue food systems and deliberately incorporating them into food and climate mitigation and resilience programs can help countries meet multiple Sustainable Development Goals (SDGs). In coastal nations in particular, blue foods are central to the fight against poverty and hunger (Goals 1 & 2). Women are 50% of the workforce in the blue food sector, making it a priority for gender equality (Goal 5). Action on blue foods will be important to achieving responsible consumption and production (Goal 12). Development of sustainable blue food systems can be a significant contribution to conserving life below water (Goal 14), of course; it is also important to conserving life on land (Goal 15), by providing an alternative to livestock and thus reducing pressure on forests and other habitats. The great diversity of blue food systems presents tradeoffs among these goals, and also often offers opportunities to achieve many at once.

Table 1 focuses on the relevance of blue foods to three priorities within the SDGs – healthy, sustainable food systems (Goals 1, 2, 3 & 12); climate change (Goal 13); and biodiversity (Goals 14 & 15).

HEALTH, NUTRITION, AND FOOD SYSTEMS	CLIMATE	BIODIVERSITY
<ul style="list-style-type: none"> • Roles and importance of blue foods for health and nutrition vary across countries. <ul style="list-style-type: none"> ○ Industrialized countries with high rates of obesity, heart disease, and high greenhouse gas emissions, blue foods offer a source of protein that is healthier than red meat, with a lower carbon footprint. ○ In developing countries, blue foods can play critical roles in meeting pressing challenges of hunger and malnutrition because they offer an affordable and accessible source of animal protein and are rich in essential micronutrients. • A single serving of many species of small pelagic fish, bivalves or shellfish provides more than the daily recommendations for omega-3 fatty acids (EPA+DHA), Vitamin B12 and calcium. Adding blue foods to a meal can also improve absorption of nutrients from plants. • Many tropical countries could solve nutrient deficiencies afflicting their coastal communities with better use of the fish harvested in their waters; 22 countries could meet the nutrient requirements of all their children under 5 with allocation of just 20% of the catch. • Governments can capitalize on this potential if they build blue foods into food system policies and programs – helping consumers shift from meat to fish and, especially, to small pelagics and farmed bivalves that have low footprints and are particularly rich in micronutrients. 	<ul style="list-style-type: none"> • Overall, blue foods have a carbon footprint comparable to chicken (Figure 3), but there is a range – some blue food systems have high emissions; many others offer footprints that are much lower than any animal source protein produced on land (Figure 4). • Blue food systems will also be profoundly affected by a changing climate. It is thus vital that blue foods be fully integrated into climate negotiations and policymaking and, specifically, into countries’ Nationals Determined Contributions (NDCs), and National Adaptation Programs. <ul style="list-style-type: none"> ○ In capture fisheries, governments can reduce greenhouse gas emissions through installation of better engines on vessels; banning production systems, such as bottom trawling, that have high emissions; and through better management. ○ In aquaculture, emissions can be reduced by shifting to better feeds, avoiding reliance on fish or on soy associated with deforestation. ○ Ocean warming will affect distribution and productivity of many fish and the health of coral reefs and coastal ecosystems. Acidification caused by GHG emissions will affect reefs and bivalves. • Blue food systems will be affected differently from terrestrial systems, and thus can be a valuable part of a portfolio of measures in adaptation strategies. The immense diversity of blue foods means that, as current systems are affected, there will often be other options that can be developed. • Blue foods were included in the UAE Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action, launched at COP 28 (Objective 5: “...promoting sustainable aquatic blue foods.”). The Declaration thus provides a clear path for bringing blue foods fully into the COP process. Follow-up to the Declaration, however, does not yet include an explicit focus on fisheries or other blue food systems. 	<ul style="list-style-type: none"> • Blue foods are integral to the Global Biodiversity Framework (GBF), adopted under the Convention on Biological Diversity in December 2022. The GBF calls for sustainable management of all areas used for fisheries and aquaculture (Target 10), for example, and for programs to foster sustainable consumption choices (Target 16). The blue food sector will also be both a vital beneficiary and an essential constituency for the GBF’s marquee mandate – the protection of 30% of marine and coastal areas (Target 3). These are targets that simply cannot be achieved without investment in sustainable blue food systems. • There are also significant synergies between blue foods and nature-based solutions that address both biodiversity and climate goals. High-priority ecosystems, such as mangroves, tidal marshes and sea grass beds, are highly efficient carbon sinks and important for sustaining healthy blue food populations.

Funding Needs and Opportunities

Unlike land-based food production, fisheries and most aquaculture systems are dependent upon public resources: oceans, coastal areas, lakes and streams. This presents an additional challenge for sustainable management and use and requires public and philanthropic investment to advance responsible use of our public resources. Yet, this investment is falling short. It is estimated that of the \$811 billion in annual philanthropic giving globally, less than 0.4% goes to oceans. Funding specifically for food systems and fisheries is far below the need.

There are many avenues for investment. Known solutions for fixing fisheries – managing access and establishing catch limits, for example – simply need more funding. There is also a lot of room for innovation in this space, to address the challenges of sustaining fisheries as climate change affects fish stocks, supporting small-scale producers at the heart of the system, and addressing pervasive challenges of equity and justice.

There are also opportunities for private investment beyond grantmaking. There is a growing community of entrepreneurs tackling challenges in the blue food sector, ranging from aquaculture feeds to transparency in supply chains, cold chain infrastructure, and platforms to support small-scale fishers and fish farmers. These ventures have the potential to play valuable roles in developing the blue food sector of the future. When made with systems transformation in mind, these investment dollars can be an important part of the equation with philanthropic and public investments to secure effective management of fisheries and sustainable aquaculture development.

Most importantly, there is an urgent need and opportunity to link efforts across food systems, climate, and oceans. That integration will be essential to mobilizing a level of investment in blue foods that is commensurate with the needs and opportunities and to effectively advancing change in these complex, interconnected systems.

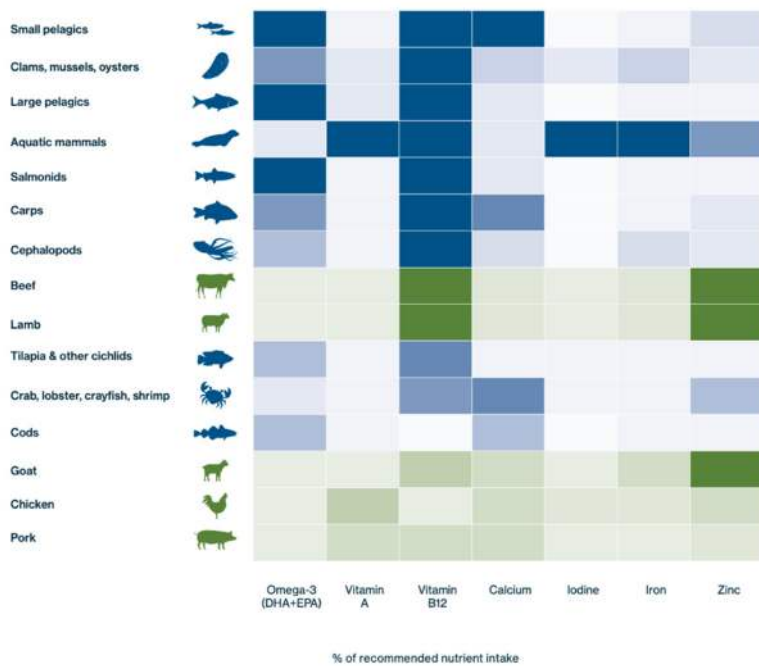


Figure 4: Chart of blue food nutrition.

CO₂e Emissions of Protein Sources

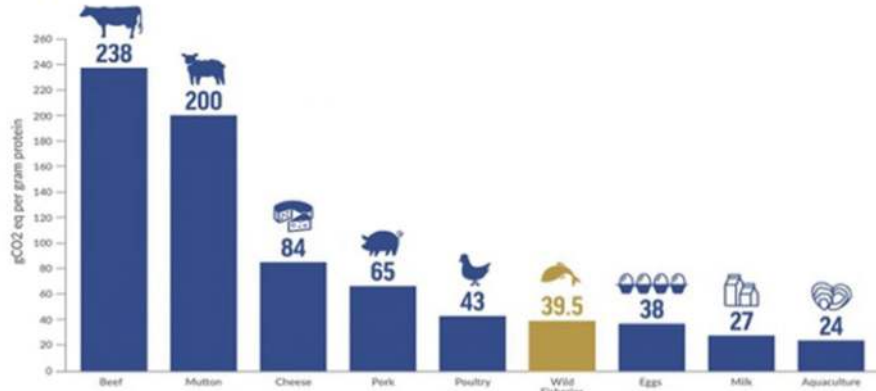


Figure 3: Overall greenhouse gas emissions of protein sources.

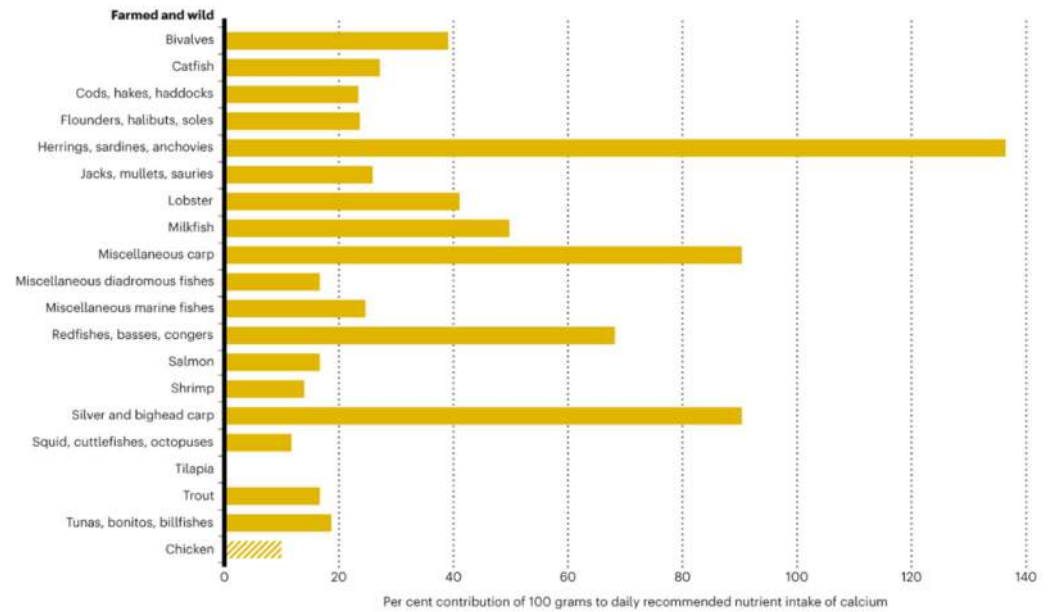


Figure 1: Diversity of blue food nutrients

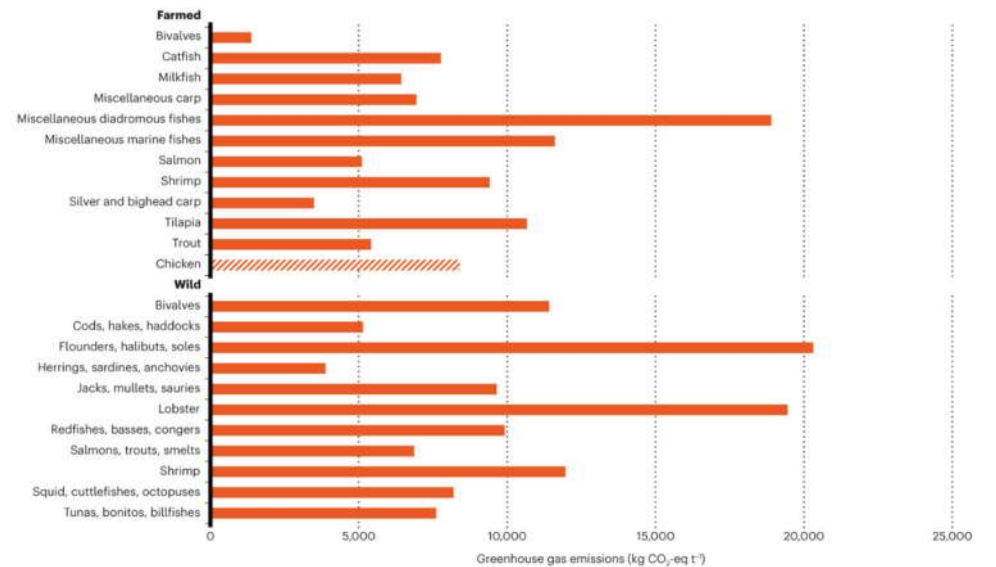


Figure 2: Diversity of greenhouse gas emissions across blue foods.