Critical Transition 4.
Securing a Healthy and Productive Ocean[xii]

	Better Futures Additional Investment Requirements 2030 *(USD billions)*	Better Futures Business Opportunity *(USD billions)*	Economic Prize from Hidden Cost Reductions *(USD billions)*	
A Healthy & Productive Ocean	2030	2030	2030	2050
	$10	**$345**	**$350**	**$785**

A healthy diet for over nine billion people will require about 85-90 million metric tonnes (MMT) of edible-weight[xiii] ocean protein annually by 2050.[101] Today, the world produces half of that amount. The total wild fish catch is 46 MMT (forecast to decline to 40 MMT if overfishing continues).[102] Ocean-based aquaculture adds only ten MMT because it is heavily constrained by the availability of feed, which is also largely sourced from fish.[103] The total numbers amount to less than ten percent of global animal food supply.

This makes little sense at a time when land is under such pressure, since the ocean produces about the same volume of plants as the land but converts them to protein much more efficiently. Clearly, producing more protein from the ocean is possible and advisable – for human health,[xiv] food supply, the environment and the health of the ocean.

Ocean productivity and ocean health can be two sides of the same coin. Wild fisheries produce best when they are sustainably managed, even in the short term. Sustainable fishing and aquaculture can make their full contribution only if essential habitats – estuaries, wetlands, mangrove forests and coral reefs – are protected and restored and if nutrient and plastic pollution is reigned in. Aquaculture, when done right, can produce protein with much lower carbon and land footprints than the typical mix of land-grown meats. And healthy coasts and wetlands are essential for ocean productivity.

[xii] This chapter does not include land-based aquaculture, as this is structurally much closer to agriculture than ocean-based fisheries.

[xiii] All metrics here are in edible weight – e.g. the weight of the fish that ends up on a plate, rather than the landed weight. They also do not include fish caught in illegal, unauthorised or unregulated fashion, which may be as much as another ten MMT, and the weight of discards and by-catch, which vary widely by species (from zero to 10x the landed weight).

[xiv] The health implications of eating fish, though overall positive, are highly complex. They are fully considered in the EAT-Lancet global diet recommendations, which provide the baseline for this discussion.

Goals and benefits

The prize is considerable:

- **Environment.** This transition, properly managed, could relieve pressure on terrestrial protein production and achieve major benefits in terms of greenhouse gas emissions, biodiversity, climate resilience and overall system integrity.

- **Health.** As with the transition to alternative proteins (Transition 5), the real gain here is the potential to increase sustainable protein supplies by encouraging more fish consumption over other protein sources.

- **Inclusion.** The restoration of fish stocks would add $53 billion[104] to the world economy in terms of landed value – considerably more if the entire value chain were included (for example, Icelandic cod products retail for five times the landed price.).[105]

- **Food security.** Sustainable sourcing of ocean protein diversifies nutritious food supplies, particularly for poorer communities that depend disproportionately on fish for their protein consumption. Diversification also reduces risks from simultaneous breadbasket failures (see Chapter 2).

The annual economic gain from this transition is an estimated $350 billion by 2030, and $785 billion by 2050. A reduction in environmental costs of $180 billion a year by 2030 would be the biggest driver of the gain.

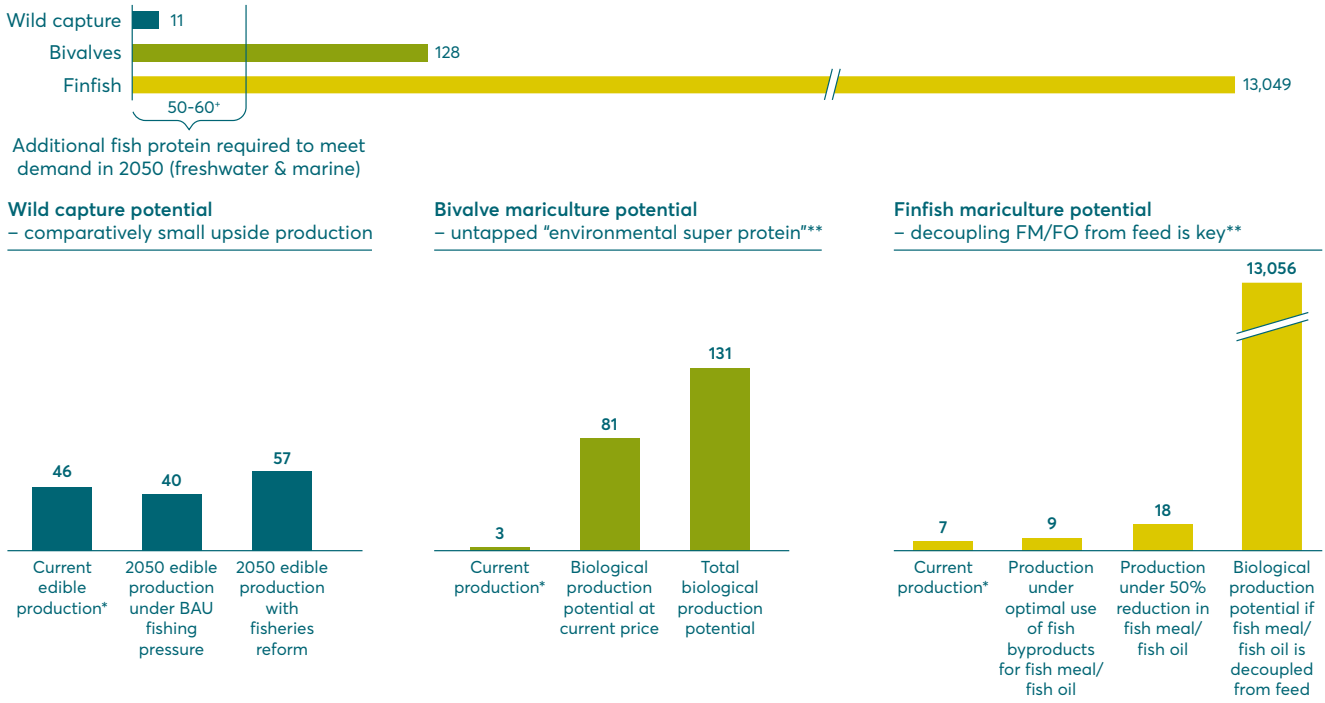
Capturing this prize depends on integrating the dimensions of production, allocation and equity, and protection (see Exhibit 23). On the production side, overfishing and illegal fishing needs to end. This would improve current yields by 11 MMT per year by 2050.[106] The farming of ecologically benign, filter-feeding molluscs (mussels and oysters) needs to increase.

EXHIBIT 23

Meeting global seafood production goals means recognising the mariculture potential

Million metric tonnes (MMT) edible weight

Comparing current production to maximum biological production potential



*** 2016 production, FAO (2018), SOFIA; scaled to edible meat**

**** Values are at current price of $1,296 per ton for wild capture, $1,700 per ton for bivalves, $7,000 per ton for finfish**

† Approximate range – assumes same live to edible weight conversion ratios.

Source: Estimating the Ocean's True Potential for Feeding the Planet, emLab, University of California, Santa Barbara, 2019

There are no bio-physical constraints on boosting current annual production of 2.6 MMT by a factor of 30. Lack of demand is the only drag on expansion. Finding alternative feed ingredients for fish farmed in the ocean is essential to reduce the need to "feed fish to fish". Some 18 MMT of farmed fish can be produced if the fish oil/meal content of their feed can be halved, and if all fish processing by-products go into fish feed production.[107] The quest for new feed sources and technologies and for low-impact fish farming technologies looks promising.

On allocation and equity, the needs of the artisanal sector are the priority. Some 90 percent of all fishers are artisanal. They provide over half of the global catch, 90 percent of which is consumed locally.[108] Their overfishing and pre-emption by commercial fishing interests can trigger severe humanitarian and food security concerns. There is no more important objective in this transition than to restore artisanal fish stocks to sustainable levels and restore food security and employment to coastal communities in the developing world.

On the protection side, health and productivity need to be tied together. Priorities to achieve by 2030 are restoring fish stocks to the healthy levels that sound economics demand, boosting tropical fish stocks by restoring 50 percent of former mangrove forests and eelgrass beds, and using the expansion of fish and mollusc farms, which require pristine waters and estuaries, to boost coastal protection and restoration efforts. By 2050, a 90 MMT protein production system will require the ecosystem services of a finely tuned network of protected areas, and an end to eutrophication fuelled by nutrient-run off from land-based agriculture.

The natural resource and overall economic efficiency of producing food from the ocean makes its own case: mussel farms use almost no land and emit no carbon dioxide, and well-run finfish farms can compete with the most efficient poultry operations.

Priority actions

Ensuring that governments, consumers, commercial fisherfolk and fish farmers, investors, and artisans benefit from the yields provided by a healthy and resilient ocean depends on tackling a set of regulatory and market failures. To achieve a transition to a sustainable ocean at the speed and scale needed, they need to work together on eight priorities.

Reform wild fisheries

Fishery reform is impossible without rules to protect stocks and allow for an efficient, fair and equitable allocation of catch. Commercial rights to fish need to be predicated on a plan to fully restore the target stock within ten years. Catch must uniformly be restricted to a level commensurate with maximum sustainable yields. Fishing rights must be allocated fairly to provide food security to artisanal fishing communities, and to align the economic and ecological goals of commercial fishers. In the developing world, this is hard to do. The data and governance capacities are still lacking. However, these fish-dependent nations are increasingly committed to reform. Their efforts could be accelerated by:

- **Providing titles and access rights.** Artisanal fishers need secure and exclusive rights to the fish stocks traditionally under their communal control. Commercial fishermen require a reliable registration of access rights to optimise their catch and fleet structure. Methods for defining, registering and trading assets and rights are quite advanced. But "free access" rights that forbid local fishers' control and stock ownership are still in force in many nations and need to be adjusted.

- **Packaging new technologies into fishery solutions.**[109] New sensing, tracking, mapping, simulation and ledger technologies can revolutionise fishery management in the developing world. The technologies are already available but applying them requires careful integration and customisation of the different tools. A network of technologists, system analysts, local technocrats and fishers is needed to design pragmatic packaged solutions in the areas of, for example, fishery simulation, fleet control, chain of custody tracking, and registering title and rights.

- **Innovating in insurance and finance.** New approaches and business models are needed for insurance against catastrophic events affecting fisheries (storms, warming events, reef collapse), and for compensating poor fishermen for cost of fish stock recovery.

- **Eliminating harmful subsidies.** Subsidies directly supporting fishery capacity currently amount to $20 billion. They need to be eliminated or redirected towards fleet control infrastructure and port improvements. This is because the most efficient and profitable fishing occurs at maximum sustainable yield levels. Capacity-enhancing subsidies distort this balance – they make fishing efforts in excess of maximum sustainable yield profitable and thus lead inexorably to overfishing. The most promising vehicle for eliminating harmful subsidies is a WTO-led agreement on fisheries subsidies.

Reform finfish aquaculture

- **Rewriting the rules.** Finfish aquaculture is underdeveloped, under-invested, over-regulated and constrained by the need to "feed wild fish to farm fish". Governments need to give feed developers clear targets (performance specifications), strong incentives (feed efficiency standards) and guaranteed demand (feed standards for government seafood purchases). Processes for awarding permits to farm fish need streamlining in light of new containment, vaccination and waste management technologies, without compromising strong, independent oversight. In addition, governments can support innovative model farms.

- **Increasing investments.** Investors need to recognise that new vaccine delivery, new feed and stronger breeding and genetics are making aquaculture investment-ready. The sector offers a range of opportunities in AI, genetic engineering and advanced technologies of the kind attractive to venture capitalists and corporate investors. Blended finance instruments are already used by China and Norway to advance large-scale aquaculture.

- **Making the case for fish to consumers.** Additional production of farmed finfish is more likely to meet new protein demand from younger generations than to replace meat in the diets of older people. But younger consumers still do not treat aquaculture finfish as a substitute for poultry, pork and beef. A stronger case for seafood needs to be launched. Civil society can play a key role in this as the problems of sustainable feed and sustainable production are solved.

There is a lot of coordination, negotiation and risk sharing required for this transition. Much of it will only happen when significant self-interest – the "use case" for each actor in ocean food production systems – makes this compelling. There are three main arguments for optimism. First, the current crisis in fisheries, especially in developing countries, is increasingly untenable. Political pressure is mounting to protect the food security of the most exposed populations. Second, new data and communication technologies can tilt fishery management, trade standards and consumer preferences decidedly towards greater transparency and better performance. Third, fishery and ocean management institutions are under unprecedented pressure to do things differently. They seem likely to rise to the challenge, given their considerable improvement in the past decade.

BOX 29

Producing omega-3 fatty acids from natural marine algae

Fish are a healthy source of protein. They contain omega-3 fatty acids that support human brain, eye and heart health. In 2018, the Dutch multinational company DSM and the German chemicals company Evonik teamed up to develop fish feed from algae. Veramaris is the first viable alternative to fish oil in fish feed. One metric tonne (MT) of Veramaris algal oil, produced through waste-free fermentation, saves 60 MT of wild-caught fish.

Owing to this collaboration, farmed salmon can have diets rich in omega-3 without fish oil. Not only does this keep the salmon healthy, it makes them a more sustainable source of omega-3 and protein for people.

References

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