Future of Fish Feed

DRAFT F3 Team Policy Recommendations for Governments
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F3 – Future of Fish Feed is a collaborative effort between NGOs, researchers, and private partnerships to accelerate and support the scaling of innovative, alternative aquaculture feed ingredients such as bacterial meals, plant-based proteins, algae, and yeast to replace wild-caught fish.

The F3 Team was initiated out of concern that overfishing of small, forage fish such as sardines, anchovies and menhaden, was unsustainable. With 85% of global fish stocks overexploited, depleted, fully exploited or in recovery from exploitation[1], it is clear that there are not enough wild-caught fish in the ocean to feed the population of the future, which is expected to need double our current yield.[2] To meet the growing demand for fish protein, an increase in sustainable aquaculture practices is necessary to make up the lack of wild-caught supply.

Unfortunately, current aquaculture practices still depend on large amounts of wild-caught forage fish as a critical input for production. An estimated 90% of forage fish are used to make fishmeal for agriculture, aquaculture, pet food, and other industries.[3] Seventy percent of that 90% is specifically used for aquaculture.[4] If forage fish populations decline, then aquaculture's supply chain for many species will face bottlenecks in their inputs, and also decline. The decline of both wild-caught fisheries and aquaculture would pose a humanitarian crisis since 20% of protein supply would effectively disappear.[5]

Moreover, overfishing of forage fish, a vital component of the marine food chain, would result in a domino effect that would lead to the collapse of whole ecosystems. Many other species that depend on forage fish for sustenance would cease to exist, including whales, seals, dolphins, sharks, seabirds, as well as commercial fisheries such as tuna, salmon, and cod. Harmful algae blooms that create dead zones, and release neurotoxins, could also grow in frequency without the forage fish to contain them. These neurotoxins threaten water quality and human safety.

Given the importance of forage fish as a source of protein, within the marine food web, and the role it plays in aquaculture, the F3 Team has generated this draft document to be circulated

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[1] Vince, Gaia. "Future - How the World's Oceans Could Be Running out of Fish." BBC, 21 Sept. 2012, www.bbc.com/future/story/20120920-are-we-running-out-of-fish.
[2] "World Bank. 2013. Fish to 2030 : Prospects for Fisheries and Aquaculture. Agriculture and environmental services discussion paper; no. 3. Washington, DC. *World Bank.* https://openknowledge.worldbank.org/handle/10986/17579 License: CC BY 3.0 IGO."
[3] Jackson, A. and Shepherd, J. "Advancing the Aquaculture Agenda: Workshop Proceedings, Connections between farmed and wild fish: Fishmeal and fish oil as feed ingredients in sustainable aquaculture. International Fishmeal and Fish Oil Organisation (IFFO)." OECD, 2010. Chapter 16, 331-343
[4] Pikitch, E., Boersma, P.D., Boyd, I.L., Conover, D.O., Cury, P., Essington, T., Heppell, S.S., Houde, E.D., Mangel, M., Pauly, D., Plagányi, É., Sainsbury, K., and Steneck, R.S. 2012. Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs. Lenfest Ocean Program. Washington, DC. 108 pp.
[5] Fishing for a Future. 2016. Getting to Eden: building an ideal future for the global fish food system through collective action (available at www.fishingfuture.org).

among governments, to raise awareness of the forage fish issue and to generate solutions for continued global well-being and prosperity.

The F3 Team welcomes feedback on these recommendations, and collaboration with governments, NGOs, and companies to attain the goal of sustainable feeds in agriculture and aquaculture, so that our shared future becomes more sustainable.

Policy recommendations for Governments

Given the importance of forage fish to aquaculture, fisheries, and the environment, our first recommendation is that **governments immediately enact regulations to end or severely restrict 'reduction fisheries'.** Forage fish declines have been so severe, that in 2015, for the first time in history, the entire forage fishery was closed from North to South America, along the entire coast of 2 continents.[6] The math is fairly simple: enough forage fish needs to remain in the environment to reproduce, and grow their population. At a bare minimum, scientists suggest at least ⅓ of forage fish biomass must remain in the ocean.[7] With population levels under that, a collapse is inevitable. These government actions need to be effective within each country, and by treaty, enacted globally to apply not only within country Exclusive Economic Zones (EEZs) but also in the areas between countries, in the High Seas.

A second recommendation is that government fund **research and development to accelerate the development of nutritionally equivalent alternatives to fishmeal and fish oil.** With alternatives available, aquaculture need not depend on the supply of forage fish for production, and can grow independently of wild-caught stocks. The list of alternative ingredients that can substitute for fishmeal and fish oil is growing. It can be accelerated with government support and global collaboration.

To encourage global collaboration, the F3 Team recommends that each government fund research and development centers that can house equipment to prepare ingredients, formulate and manufacture batches of feed for experimental and pilot scale operations, to accelerate the discovery of new and cheaper alternative ingredients. The payoff for this research is huge, not only from an environmental perspective, but also from a humanitarian and economic perspective since alternative ingredients can address multiple high value markets that ensure food security such as agricultural feed, pet food, and human nutraceutical markets, which combined have a global market value of over $800 billion USD.[8] Because of the critical role forage fish have for environmental safety and food security, the F3 Team recommends that governments act now to preserve forage fish stocks and to avoid a global crisis.

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[6]Grossman, Elizabeth. "A Little Fish with Big Impact In Trouble on U.S. West Coast." *Yale E360*, 18 June 2015, e360.yale.edu/features/a_little_fish_with_big_impact_in_trouble_on_us_west_coast.

[7] Cury et al. 2011. Global seabird response to forage fish depletion--one-third for the birds. Science 334(6063): 1703-1706

[8] "Global Feed Production." International Feed Industry Federation (IFIF), 2016, www.ifif.org/pages/t/Global+feed+production; "Global Pet Food Market - Analysis of Growth, Trends, and Forecast (2018 - 2023)." Mordor Intelligence, Mar. 2018, www.mordorintelligence.com/industry-reports/global-pet-food-market-industry; "Global Nutraceuticals Market - Growth, Trends and Forecasts (2017 - 2022)." Mordor Intelligence, Dec. 2017, www.mordorintelligence.com/industry-reports/global-nutraceuticals-market-industry.