



MERRY FISHMAS & HAPPY NEW YEAR!

The Future of Fish Feed means more
Fishes in the Sea

Dear Friends,

In 2020, we continued the F3 Challenge - Carnivore Edition. Motivating the challenge is that most tiny forage fish such as sardines, anchovies and menhaden, are ground up into fishmeal and fish oil, as an input into the aquafeed industry and aquaculture. Since forage fish sustain birds, marine mammals, and many commercial fisheries, formulating replacements as soon as possible can prevent their functional disappearance and whole ecosystem collapse. There are not enough fish in the ocean to feed a world of 9 billion, so we will need to rely on aquaculture for marine protein and nutrition.

The F3 contest challenges the aquafeed industry to keep wild caught fish in the ocean, offering a series of prizes to companies that create and sell the most feeds without fishmeal or fish oil. Innovation in this area not only benefits the environment, but assists the aquaculture industry, since innovation can create new frontiers of possibilities releasing aquaculture from resource constraints and dependencies on wild caught forage fish that are currently bottlenecking growth. The current Carnivore edition focuses on carnivorous species that consume more wild-caught fish.

Like many other endeavors, the F3 Challenge was affected by COVID-19, and we have extended the timeline of the current prize to a future date when verification is possible. On the bright side of things, our timeline extension enabled more contestants to register.

- 6 Companies are Registered!
- The original F3 prize was doubled to \$70,000 per Award Category. Stay tuned for another exciting update next week!

Register for the F3 Challenge



Public awareness continues to be raised with 412 articles mentioning the F3 Challenges in the past 4 years with a potential reach of 159 Million viewers globally.



F3 research progressed: Several studies showcasing success in fish-free feeds for new species were published in peer-reviewed and technical publications this year, demonstrating that fishmeal and fish oil replacement are technically possible for carnivorous species.

- ½ of global fishmeal is consumed by shrimp. Fish-free feeds (F3) were achieved for Pacific whiteleg. The F3 feed performed as well as a commercially popular feed in terms of growth and equaled survival for EMS and was better for WSSV diseases ([#1](#), [#2](#)).
- F3 was also successfully achieved for several carnivorous finfish species:
 - Largemouth bass, a freshwater carnivore, was reared on an F3 diet that did not compromise growth, health or consumer acceptance ([#3](#), [#4](#), [#5](#))
 - Yellowtail (Seriola species), marine carnivores, also performed well with fish oil replacement that did not compromise growth ([#6](#)), but more importantly, a cost-effective and commercially viable F3 diet was identified ([#7](#)). **This was the first success of fish-free feeds for a carnivorous, marine fish.**
- We are awaiting results for red drum and Florida pompano.



In 2020, alternative ingredients startups attracted more investment. When we began six years ago, startups had formed but were still a glimmer in their eye, as they sought funding. Now, many are seed funded and some have completed Series A and B rounds. Many are partnering with major feed companies like Skretting or ADM, AgriProtein and Innovafeed are building larger scale plants in the US. Veramaris' fish oil substitute \$200 million plant went live this past July. Barley protein concentrate is also gaining investment, with plants being built around the world.



Ingredient companies are also receiving regulatory approvals. Over the past few years, insects can now be legally sold in feed in Europe and the US. KnipBio and Veramaris received GRAS (Generally Recognized As Safe) approval from the FDA so they can be used in human food as well as animal feeds. **Substitute ingredients are coming online and scaling.**



It should be no surprise then that the feed industry also made progress! The largest salmon feed company, Skretting, has partnered with Novonutrients, and now has an F3 salmon feed. Previously, Evergreen Feeds developed a fish-free feed for another popularly consumed species, tilapia. Feed companies are recognizing that fish-free feeds are an industry insurance policy.



Consumer awareness is increasing, and in 2020, fishmeal and fish oil reduced products are entering the market. In France, algae-fed [trout](#) and [salmon](#) are now available; in Germany through Kaufland; and in the US by mail-order delivery through KnowSeafood.



Experiments in 2020 showed that **traceability of ingredients in feed is not an issue**. Fish-free feeds can be tracked in [Largemouth Bass](#), through an unique isotope analysis fingerprint. Traceability for other species is being determined.



Looking Ahead to 2021...

- More research in 2021 will demonstrate fish-free feeds:
 - In more major aquaculture species
 - At a commercial scale in farm conditions
- A flowchart will assist ingredient companies with understanding the experiments that need to be completed to substantiate ingredient value for aquafeeds.
- A new database corresponding with the flowchart will showcase fishmeal and fish oil substitutes, Aquaculture Feed Ingredient Resource Engine (AFIRE). This database will house research results on ingredient performance to accelerate substitutes.



Fishmeal and fish oil substitutes are flourishing: More sustainable fishmeal and fish oil substitutes are becoming commercially available. We will highlight these in an upcoming webinar series in 2021! Stay tuned!

In short, the aquaculture industry has realized that they have a strong incentive to hedge their bet on the instability of wild-caught feed ingredients by expanding the market for fish-free alternatives and confronting an existential threat. Investors also see the opportunity and are scaling alternatives. More to come in 2021! Happy New Year!

Best Regards,

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The Future of Fish Feed (F3) is a collaborative effort between NGOs, academic institutions, and private partnerships to accelerate the commercialization of innovative, substitute aquaculture feed ingredients to replace wild-caught fish.

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