

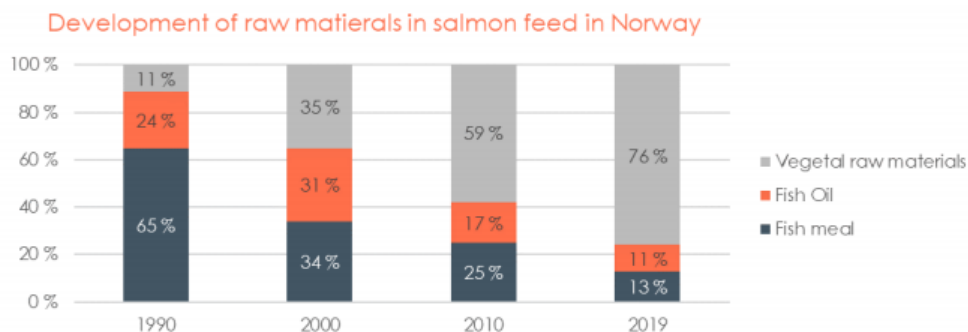
Nordic Aquafarms (NAF)– Guidance on Sourcing Feed

April 2, 2021

Consumers are increasingly concerned about the food they eat. They want to be sure that it is safe, healthy, ethically raised, and has positive social and environmental influence. In addition to the purity of our water, the feed we provide to our fish will play a major role in delivering customer satisfaction and recognition of our brand as a leading seafood product.

Modern aquaculture feed is formulated based on the nutrient requirements of the fish rather than specific raw materials. Since the commercialization of salmon farming more than 60 years ago, the industry has learned a great deal about the specific nutrient requirements of salmonids (e.g., amino acids, fats, micronutrients, etc.), and how these can be met using a variety of raw materials.

Today's aquaculture feed includes ingredients from terrestrial crops (i.e., wheat, corn, soy, canola), byproducts derived from land animal proteins (i.e., poultry meal/oil, bone and blood meals), and ingredients derived from the marine fisheries (fish meal/oil, krill meal/oil). With respect to marine ingredients, both salmon producers and feed suppliers identified quite some time ago that these materials are finite and have since directed extensive resources into research and development focused on reducing dependency on such materials. As a result, the average inclusion rate for marine-derived ingredients in salmon feed has been reduced from a level of 90% in the early 1990's to approximately 20% today (oil and meal combined). It is expected that this trend will continue and by 2029 aquaculture will drop to be the number three consumer of fish meal and fish oil behind poultry and pig farming, and nearly on par with pet food.



NAF expects that our feed will initially include around 15% marine ingredients which represents 'best in class' with regard to sustainable feed formulation for salmon farming. While NAF has not made a final decision on a feed supplier for the Samoa facility, we have established criteria which will guide the selection of our feed profile. Due to the size of the production volume, NAF is in a position to customize its own feed formula together with the feed supplier.

This guidance criteria include:





1. NAF will use only natural carotenoid pigments that includes astaxanthin. Pigment is a vital micro-nutrient for the health of salmon and gives the orange-pink color to the fish's flesh. This pure ingredient is made through a natural fermentation process of microorganisms and has no additives, is non-GMO, and contains no preservatives.
2. NAF will avoid the use of GMO ingredients in our feed.

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3. NAF will integrate the use of ingredients that are viable alternatives to harvest fisheries:
 - a. Vegetable proteins and oils
 - b. Insect meal
 - c. Single cell proteins and oils (e.g., bacteria, yeast or microalgae-based products)
4. NAF will utilize byproduct trimmings from consumption fisheries. Today this can be as much as 20% of the fish meal utilized in our feed formulation.
5. NAF will be committed to supplying a product that delivers essential omega-3 health benefits. The origin of two essential long-chain omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) has traditionally relied on fish oil inclusion to feed. However, this is no longer an obstacle thanks to access to new alternative oils that can be used to tailor the total omega-3s and the ratios of EPA and DHA without reliance on fish oil (Algae-oils is an example of this).
6. NAF will require that our suppliers have a monitoring program for environmental contaminants in the feed they produce for us, and follow-up with our own in-house quality assurance program for feed quality.
7. NAF will require that our feed supplier have a program of traceability for determining the origin of ingredient used in our feed. This is especially true with responsible sourcing of fish meal, fish oil, and soy ingredients.

Aquaculture is among the most feed efficient production models in farming (see image). Furthermore, modern land-based RAS facilities like the system developed by NAF include technology which enables precise feeding and environmental control, making it possible to achieve even lower feed conversion ratios (FCR = kg feed/kg fish produced) than the current industry standard. The required feed volume on an annual basis can be calculated by multiplying the production output of the farm by the anticipated feed conversion ratio. At full scale operations, our facility is designed to produce 25,000 metric tons of whole round fish annually. We expect to achieve a feed conversion ratio of 1.1.

				
Protein retention	28 %	37 %	21 %	13 %
Calorie retention	25 %	27 %	16 %	7 %
Edible Yield	73 %	74 %	73 %	57 %
Feed conversion Ratio (FCR)	1.3	1.9	3.9	8.0
Edible Meat per 100 kg fed	56 kg	39 kg	19 kg	7 kg

Marine Ingredients

Fish meal and fish oil come from small pelagic fish species that include various anchoveta, herring, menhaden, mackerels, pilchards, capelin, smelts and sand eels. These forage fish species are fast growing, early maturing, and when the environmental conditions are optimal, they can reach very high abundance levels making them frequently resilient to fishing pressure. Such Low Trophic Level fisheries are managed as single species stock and under direct and effective fisheries management. There has been, and continues to be, significant scientific effort on improving the predictability of the stock health and removing uncertainty of stock modeling and management.

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Other sources of fish meal and fish oil come from fisheries by-products, such as trimmings from fish processed for human consumption. Today, it is estimated that roughly a third of fishmeal produced is made from seafood by-products from consumption fisheries. While the increased use of food by-products in fish meal represents a positive sustainable development, salmon by-products will not be reused as ingredients for salmon feed. Trimmings from our processing facility will be converted to by-products that can be sold as ingredients in pet food, livestock feed and/or human health products (i.e., supplements).

It is known that marine derived ingredients such as fish meal and fish oil can contain environmental contaminants through bioaccumulation occurring in the natural environment. However, the concentrations of contaminants depend on the source of the fish and only a minor part of produced fish meal and fish oil has a content of undesirable organic pollutants above maximum permitted levels (MPLs) set by European Commission and the US FDA. In order to comply with the regulations, reduction of contaminants in finished feed can occur by three strategies (1) use of marine ingredients with intrinsic low levels of environmental contaminants, (2) use of decontaminated fish oil and fishmeal. (3) use of non-marine feed ingredients. NAF together with our feed supplier will employ all three methods to ensure that the feed we use will be safe for our fish, our customers and the environment.

Sustainability

In the aquaculture industry, various certification bodies foster and promote responsible practices throughout the value chain, from ingredient sources to farm operations. To maintain certification, members must demonstrate adherence to environmental, social and ethical standards. Different certification bodies focus on different segments of the value chain and some have standards which apply to multiple segments. Certification bodies and initiatives like the Marine Stewardship Council (MSC), International Fishmeal and Fish Oil Responsible Supply (IFFO RS) and Fisheries Improvement Projects (FIP) audit sources of marine derived raw materials. These certification systems allow feed suppliers to identify and source materials like fish meal and fish oil from responsible suppliers and maintain partnerships with companies that meet the requirements of their sustainability profile.

For aquaculture farms, there are several sustainability indexes that are used to measure resource utilization or environmental impact. The Fish-In-Fish-Out ratio (FIFO) has been widely adopted to measure the ecological efficiency of feed. At the farm level, FIFO compares the tonnage of fish consumed via feed with the tonnage of fish produced. At Nordic Aquafarms where our sustainability commitment extends to feed, we will initially set target limits for FIFO that are among the best in the industry and well within certification schemes such as ASC, BAP, or Global GAP. The continued improvement of FIFO will be a key guidance principle for Nordic Aquafarms.

Conversion of forest to agricultural land through deforestation has become an increasing concern when sourcing crop-based feed ingredients. Of particular concern with aquaculture feeds is soybean meals and palm oil. It is important to know the origin of these raw materials, and to ensure they have been sourced according to recognized certifications schemes for responsible production. NAF will require our feed supplier to have traceability in place for ingredients that might come from high-risk regions and ensure those ingredients are purchased with freedom from both legal and illegal deforestation.