

Krill Industry

Lets Talk More About The Production Side And How it Impacts Consumers

August 2020

Summary

Three key factors have led to incumbents and insurgents' success in the South Antarctic krill fishery. They are: (1) political support; (2) capitalizing on proven markets; and (3) advanced engineering solutions.

Aside from the challenge of sound business model design, the risks are financial, political, and regulatory. Norwegian companies are currently the strongest competitors, in production output, installed infrastructure and quality-driven practices.

Tharos designed a multi-matrix at-sea process to balance such risks. It combines dried meal, frozen meats, plus food & pharma-grade oils from Tharos' patent-protected technology. Oil and meal profit from an expanding market. Meats, although old in origin, remains a small, niche category product, a model with a 10-year at-sea operation EBITDA >USD15M.

Tharos' zero-waste process includes 100% solvent-free oil extraction and re-utilization of waste from the meat line, the entire manufacturing takes place at-sea, and the carbon footprint cut in at least half vs. any alternative model.

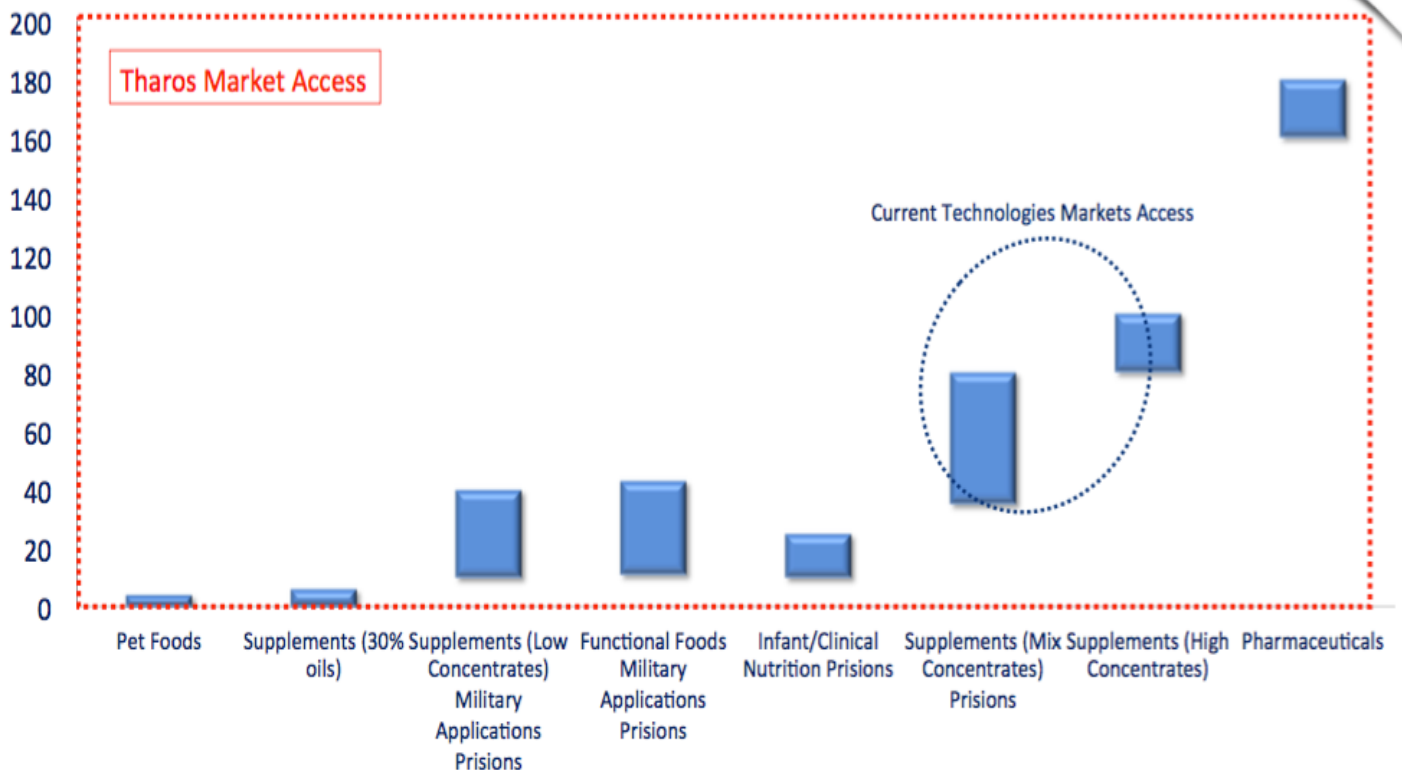
Krill oil costs play against the consumer in all current models. This is due to their reliance on manufacturing dried meal on-board at-sea, and extracting oil onshore. One Norwegian Company plans to freeze an intermediate product at sea and reprocess onshore to a variety of end products. Chinese are full on meal for feed and on-shore oil extraction, as well as fresh frozen krill for on-shore meat extraction.

Meats and oils enjoy >2% CAGR. Hydrolyzates are a work-in-progress. And buyers are aligned for meats subject these have a sustained supply, at lower prices.

New and competitively priced products beyond the marine industry are gaining attention. These products focus on waste, larvae, algae, and GMO vegetables. Simultaneously, the market is pressured by NGO's to limit its purchase of krill products, and the CCAMLR¹ has increased fishing restrictions. More fishing zoning is expected. Nevertheless, Arctic krill fishing can open new business categories, commit to environmental requirements, and reduce its carbon footprint.

Tharos' low-cost solvent-free on-board oil production allows selling at lower prices vs. any current supply. It will open vast new markets, as pharma ones.

THAROS KRILL OIL – NEW MARKET PARADIGM



¹ <https://www.ccamlr.org>

² <http://www.tharos.biz/breaking-news-once-again-krill-oil-is-in-the-spotlight/>

Insurgents can make the most of the following: (1) good market dynamics; (2) the burden of high operational running costs; and (3) the willingness of consumers to increase their purchases when offered cleaner and cheaper krill oil products. But this has to rely on a manufacturing process that takes place entirely at sea and is 100% clean, as the South Korean krill oil recall show us^{2 3}.

Consumers all over the world, no matter which market research is reviewed, claim for the cleanest and fresher krill oil, but it is no longer willing to keep paying current high prices.

Frozen meat is a small niche product with an untapped market. Its potential is twice the size of current supply.

Krill hydrolyzates on their side have had tumultuous years that proved to be very damaging to buyers. They need the product but fear another supply constraint.

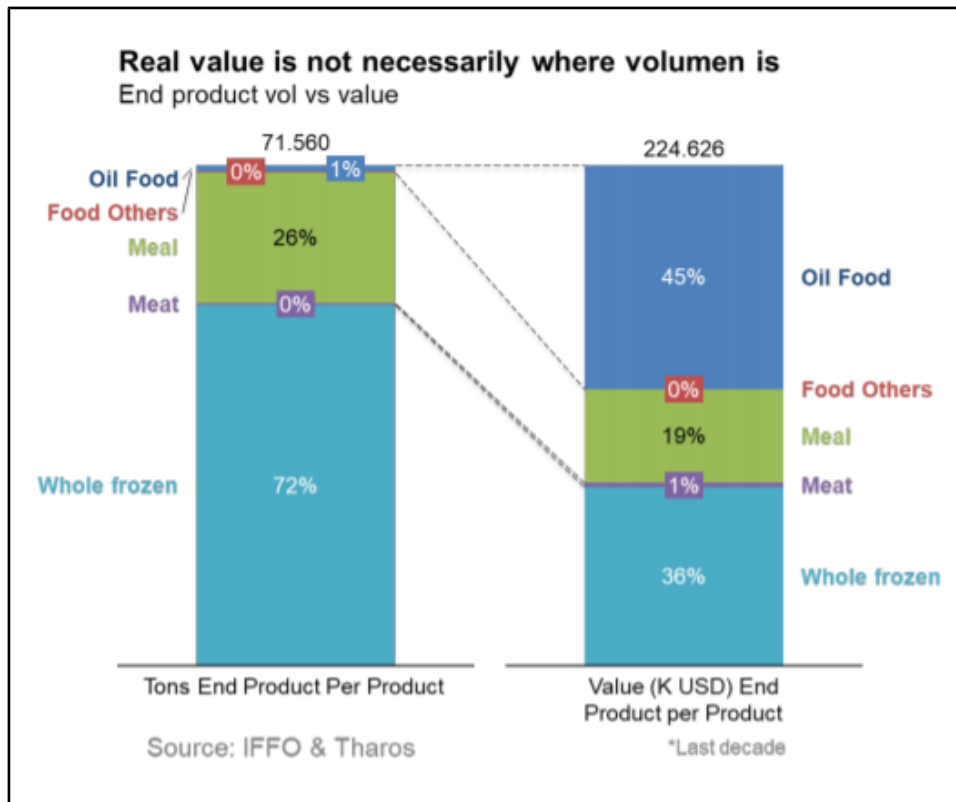
A consumer-oriented business model sustains itself via a low-cost process, aligned with market dynamic. All products are manufactured at-sea. After more than 40 decades of Antarctic krill fishery and 9M tons of processed raw fresh krill, none of the original players exist. From the ones still operating since the mid-90s, few persist.

The current dominant player has a 17-year Antarctic operation without a sustained, long-term year-over-year positive EBITDA. Government support is enough for Chinese operators. This support, along with banking preferences and the financial hedge of their parent companies, are all that matters, it seems. Other 3 countries' players are part of the story.

² <http://www.tharos.biz/breaking-news-once-again-krill-oil-is-in-the-spotlight/>

³ <http://www.tharos.biz/following-the-spotlight-list-of-south-korean-recalled-krill-oil-brands/>

Over 90% of the Antarctic fishing effort is focused on dried meals and whole frozen krill. In comparison, krill oil receives less than 1% of this fishing effort, yet it generates close to 50% of the krill fishery revenue.



Frozen krill and dried meal are the second and third-highest revenue producers.

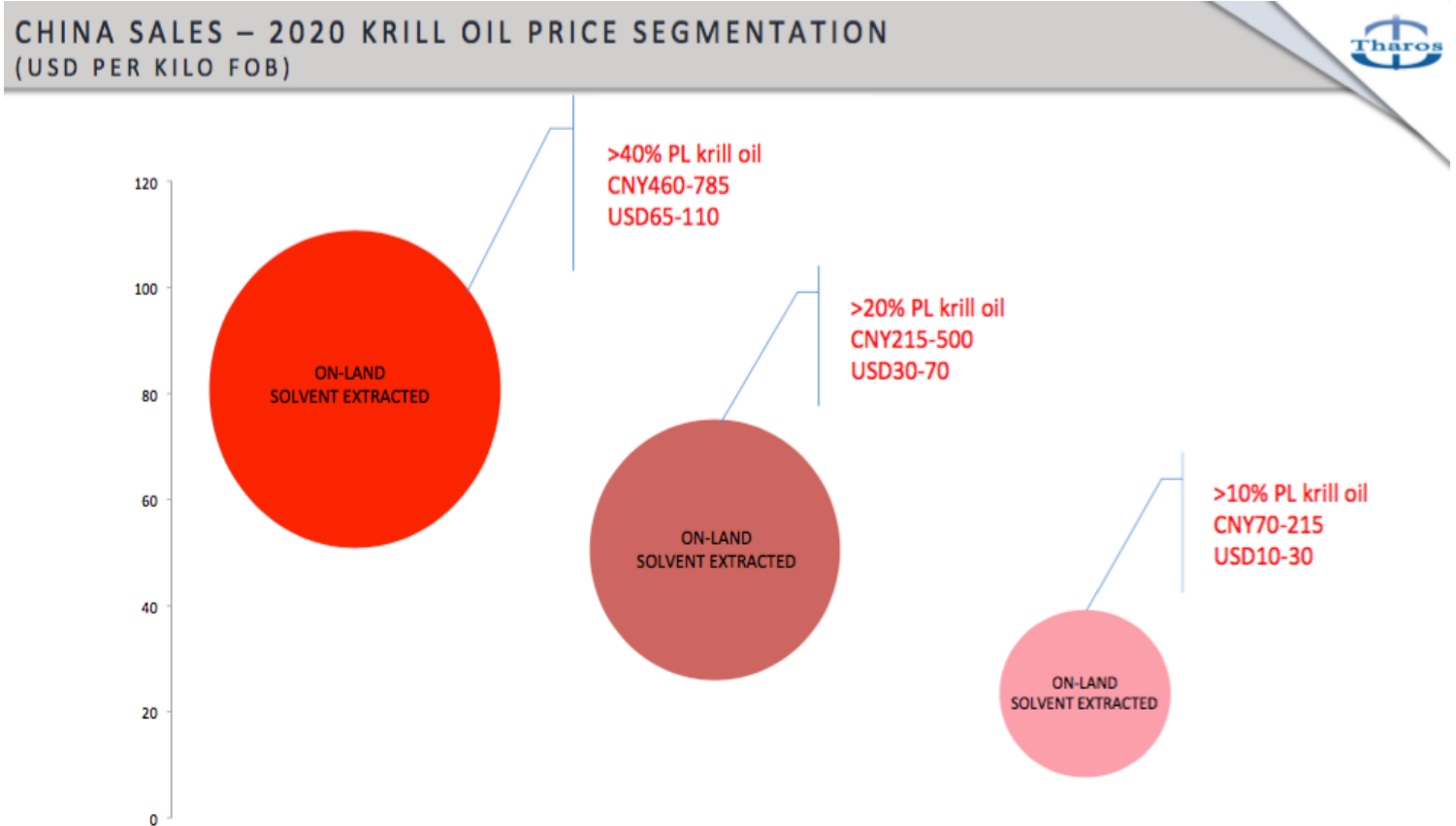
In a marine world context, this tonnage pales in comparison to the marine-origin annual production of 4.5M proteins and 1.2M oils⁴.

From a global perspective, B2B Omega-3 enriched marine oils in the food-grade category shows a CAGR of >2% per year in the past two years. Growth rate is expected to continue in this way for at least three more years. Market value is estimated at USD1.3bn at the ingredient level. Refined and concentrated oils take up 55% of the global supply. In terms of geography, the USA and the EU combined control 60% of the market with a 60k ton volume. In comparison, krill oil has less than 1% in volume but >6% in value, USD73M in B2B sales, USD91/kilo average price.

⁴ IFFO 2018

After enjoying a two-digit CAGR for several years, fish oils went on a negative spiral in mid-2010. The value of some of the most important sources (concentrates, krill, and algal oils) was impacted by significant price drops from 2016-2017, due to excess capacity, poor science making headlines, and increased competition. Menhaden, cod liver, and krill oil were the few oils that saw a downturn in value. Alga oil also reduced in value, but to a lesser extent.

The world's krill oil market was affected by excess in krill oil's processing capacity, primarily in China. Nonetheless, high krill oil prices remain a deterrent.



Although underdeveloped markets are expected to become major sources of growth for all types of marine oils, krill meal and oil remain niche ingredients. Both ingredients will remain a minor fraction compared to the supply of African, East Pacific and North European fisheries' fishmeal and oils.

Tharos estimates the annual demand of >4,200 and >120,000 tons for krill oil and feed-grade meal, respectively. This compares with the current supply of circa 780 and 45,000 tons, respectively.

Food-grade krill oil's untapped market of >4,200 ton/yr. is achievable if current prices are trimmed beyond the 25% mark⁵. Prices are anchored at USD70-125/kg FOB⁶, although a very few are listed at USD135/kg FOB for high concentrate krill oil (>55% PL).

New extraction technologies and larger processing capacity will take prices below USD70/kg for krill oils that are 100% pure and not blended as it happens today from several suppliers.

Future supply will depend on two important factors: (1) market forces; and (2) CCAMLR licensing and regulation processes.

Tharos B2B FOB⁷ price target, first delivery price⁸:

O Krill Oil <USD 65/kg

O Krill Meal <USD2.4/kg

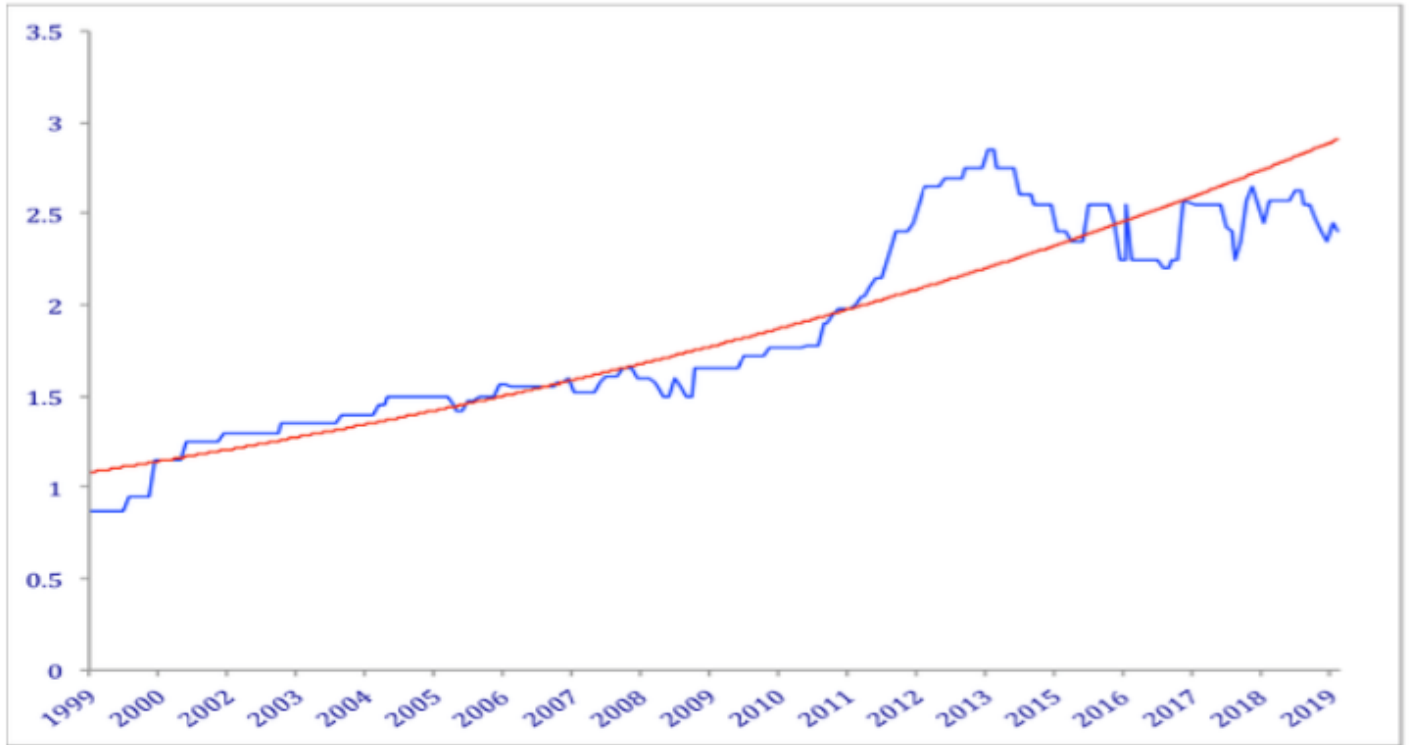
⁵ Krill oil production grew from 5 to 1,450 tons/yr. in 3 decades (2013). This has halved since then due to strong deterrents faced by the entire Omega-3 category. Since the late-90s, human applications have triggered new processing designs, sourcing the market with pricy phospholipids (PL) enriched oils, away from feed applications.

⁶ All prices indicated in this report are based on INCOTERMS FOB, unless otherwise indicated.

⁷ From USD 475-775/ton FOB in the late-80s to USD 2.25-2.55 (feed) and 2.75-3.25/kg. (oil extraction)

⁸ Food-grade oils from USD 525-675/k FOB in the early/mid-90s to the current USD 95-145 (bulk, high quality, not blended, human applications). Lower qualities (less phospholipids/pigments) USD 87-95/k FOB (bulk, mid/low quality, blended, human applications).

Krill Meal Historical Prices (USD\$/kg)



Source: Tharos trading activities

Tharos' prices are lower than current market conditions. This is due to Tharos' outlook on how the following drivers will impact prices:

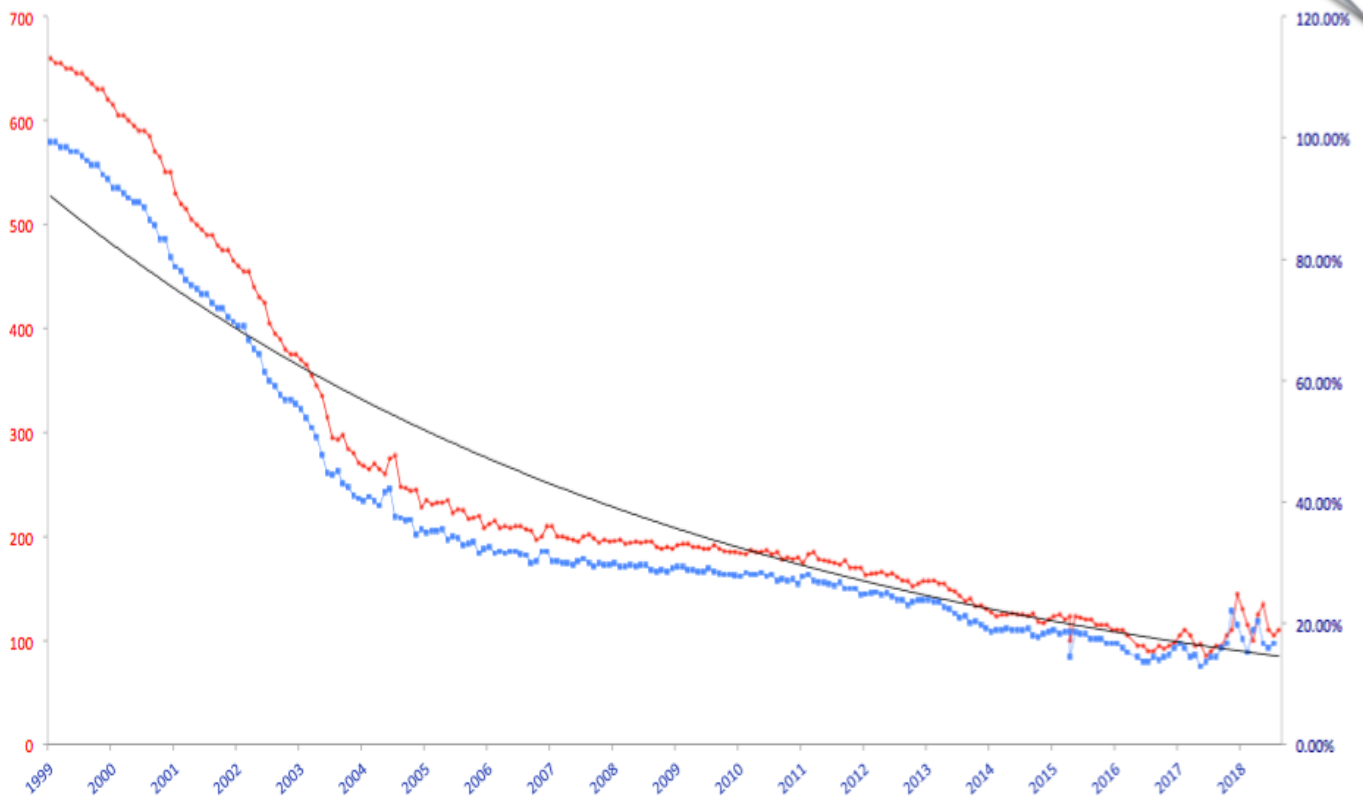
- Insurgents' known price-cut strategy.
- The overcapacity of Chinese oil extraction.
- USA + EU market conditions.
- Slow recovery of the Omega-3 category after the past downturns.
- Latest negative press impacting the entire marine oil category.

○ New sources of algae, mesopelagic and GMO species.

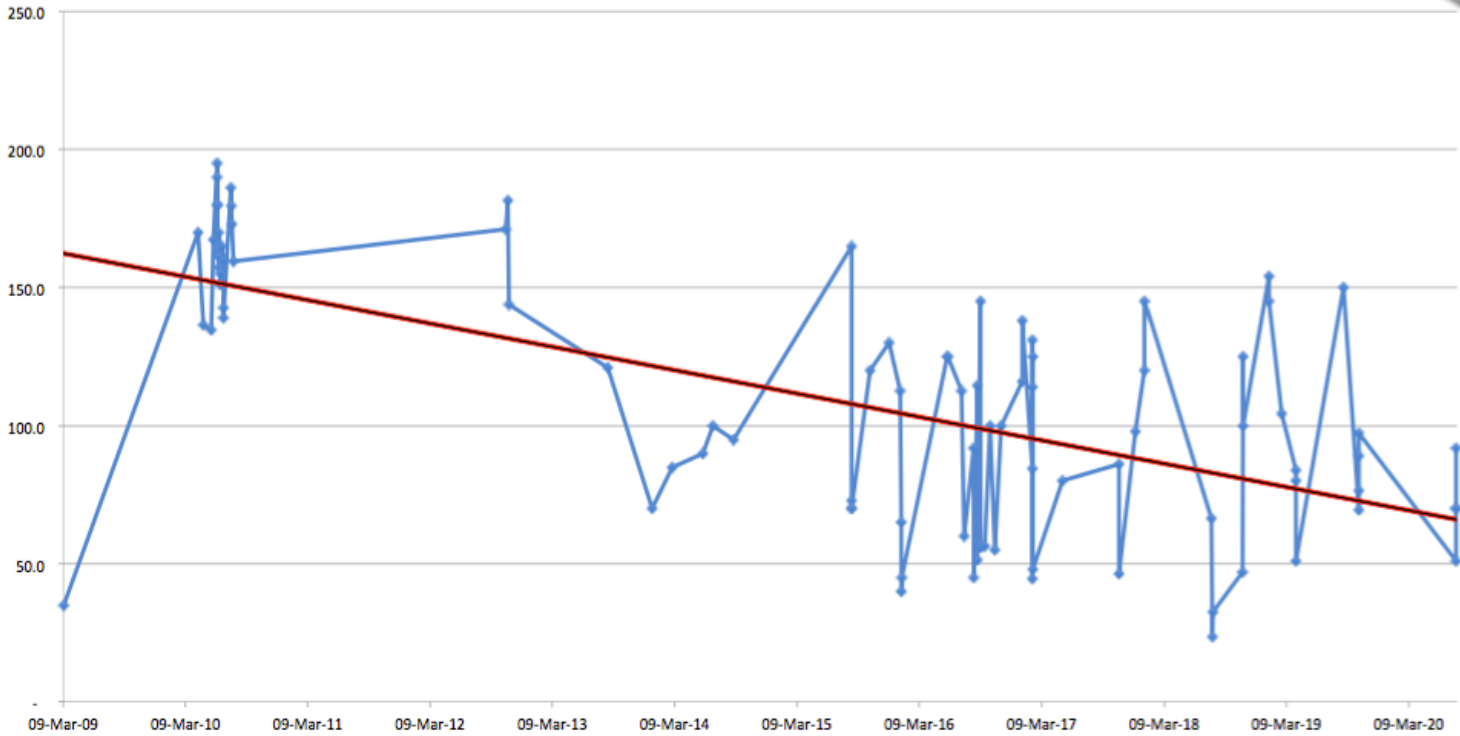
○ Chinese oil “*blending*” practices affecting price stability and market confidence in the category.

In a high-offer scenario, such as for krill oil for example, prices will follow a downturn curve. Due to the technological advances, new oil extraction technologies will mean a less significant price cut vs. traditional krill oil processes.

KRILL OIL – PRICE PERFORMANCE 20-Yr THAROS SALES (USD/K FOB)



KRILL OIL – PRICE PERFORMANCE
10-Yr THAROS SPOT SALES (USD/K FOB)



Algae-based oils (2016-2018), for example, were priced USD150-160/kg. This was at a 1.5% concentration of normal astaxanthine—half the price seen in 2012—signalling price stabilization. As a result, krill oil can sustain Tharos’ price concept.

USA’s Food Safety Modernization Act (FSMA), “*Preventive Controls for Human Food Regulation*”, the “*Foreign Supplier Verification Programs*”, and several other rules add more regulatory hurdles. When managed well, these hurdles will help with gaining market share.

Regarding fresh frozen krill (FFK), it is primarily focused on feed and bait applications targeting colour (and weight) size. Polish companies are no longer operating, while Japanese standards are available through South Korean krill operators that took over former Japanese trawlers, as one Chinese operation did. However, these are soon to be decommissioned. FFK prices range USD0.85 - USD1.85/kg FOB depending on several quality parameters. Chinese FFK is priced at +10-20% lower than the Japanese standards.

Arctic krill operations target FFK for ASEAN markets. Arctic FFK has x10 less fluoride than the Antarctic's, which is a major market bonus.

On-board manufactured frozen krill meat has prices in the range of USD3.75 to USD7.15/kg FOB, with asking prices as high as USD8/kg FOB, subject to quality variables such as but not limited to if boiled or not, packaging, coloration, sizing, with a supply range of 550-1,400 tons/season.

There is also Chinese krill meat manufactured on-land from Antarctic FFK processed at-sea several months before. Knowing what happens when krill oils are extracted on-land from krill meals also manufactured at-sea several months before; we can guess what happens with that Chinese-made meat.

There is a growing demand for krill meats. Tharos' focuses on HORECA⁹ channels. The most demand, however, remains in the EURASIAN Economic region. Quality-wise, Northern Atlantic krill shell constituency has a very low fluoride content. As a result, it's possible to freeze whole and sell the krill shell as "*meat*" for special market niches. The freeze-dried, fresh raw krill manufactured in the early '90s was sold by Tharos as a "*sexual enhancer*" in Taiwan and Japan, priced >USD14/kg FOB.

Competitive forces beyond krill manufacturers are found in vegetable oils and meals. Genetically modified (GMO) vegetables supply enriched EPA + DHA lipids and protein for aqua-farmed feeds and human consumption. Chia and flax oils are also stealing the spotlight, as is algal oil. Insect and vegetable proteins are doing the same on the proteins side.

⁹ Hotels, Restaurants, Casinos.

Once GMOs become more widely accepted and krill products face sustained pressure to limit the fishery, the impact won't necessarily be higher krill meal/oil prices. On the contrary, searching fishing technologies (dealing with limited capture areas) and on-board processing (higher value per captured ton) will become more efficient.

The new generation of products will also drive growth. This includes Arctic krill oil applications in the medical, cosmeceutical and nutritional fields. Its content of phospholipids and FFAs (free fatty acids) will make it a valuable "*new entrant*". Akerbiomarine is working on several pharma applications.

Marine Stewarding Certification (MSC)¹⁰ is one of the certifications making a remarkable "*market*" impact. MSC labelled supplements account for over 20% of the value share, with sales growth of more than 23%, compared with the total -1.3% decline in Omega 3 supplements. Although Greenpeace¹¹ has recently jeopardized MSC's credibility, it remains a trusted certification brand, recommendable for any krill operation. Friends of the Sea¹² is also an option. A fishery "*good conduct*" certificate is mandatory. MSC certification covers every level of the supply chain, including:

- More than 300 world fisheries
- 14% of the global marine catch
- 3,300+ world companies
- 23,000+ products
- More than 1,000 SKUs in the US

We are ready to talk about Tharos' rationale behind our model, sustaining numbers, market drivers, and all what you need to take a good business decision.

¹⁰ <https://www.msc.org/>

¹¹ <https://www.greenpeace.org.uk/boots-risky-krill-oil-antarctic/>

¹² <http://www.friendofthesea.org/>