

Fish oil availability going forward

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based on a memo to the Norwegian Seafood
Federation

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Fish oil availability going forward

- Insufficient supply of marine oils will change the Salmon Industry
- Alternative sources with omega-3



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Insufficient supply of marine oils will change the Salmon Industry

- **Stable total volumes – indicate responsible resource management**
- **Acute situation may arise in three years**
- **The potential for further substitution of vegetable oil for marine oils is uncertain**
- **A different salmon industry emerges**

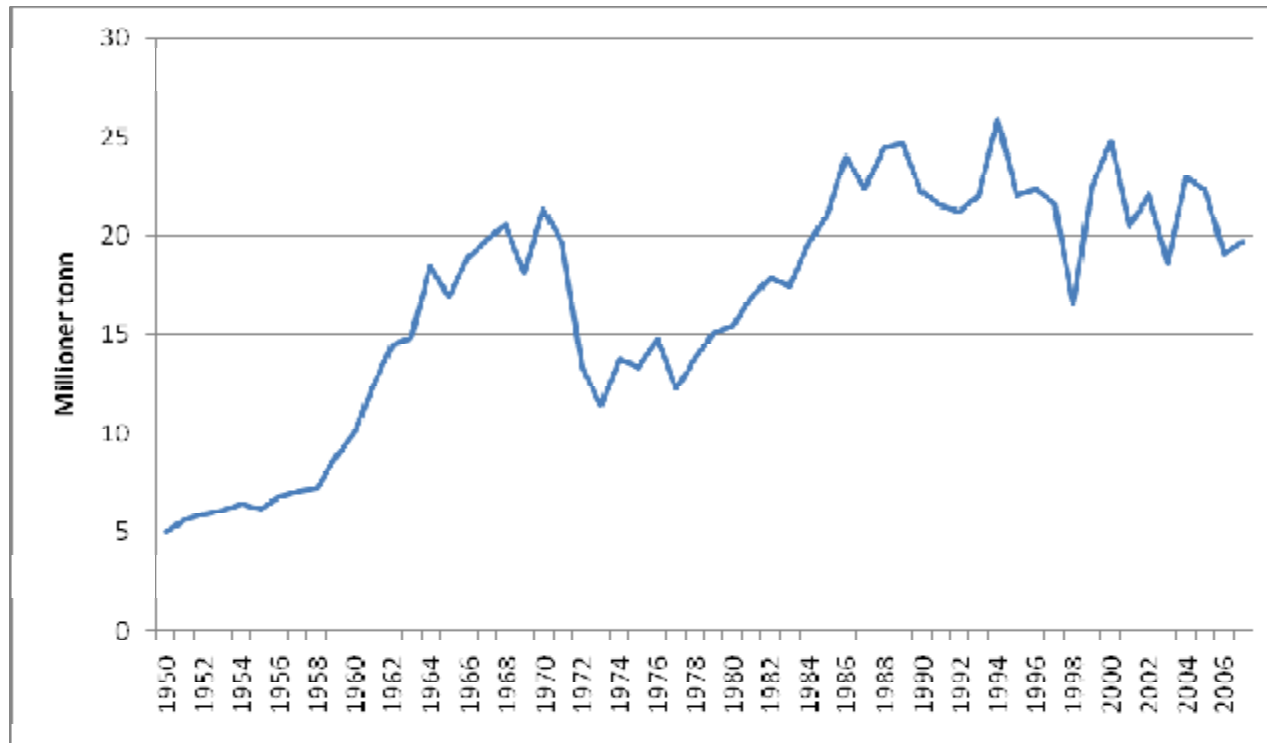


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Relatively stable level of catches since 1988

*Global catch of pelagic fish like anchoveta, caplin, Nordic herring etc.
Tones, mill*

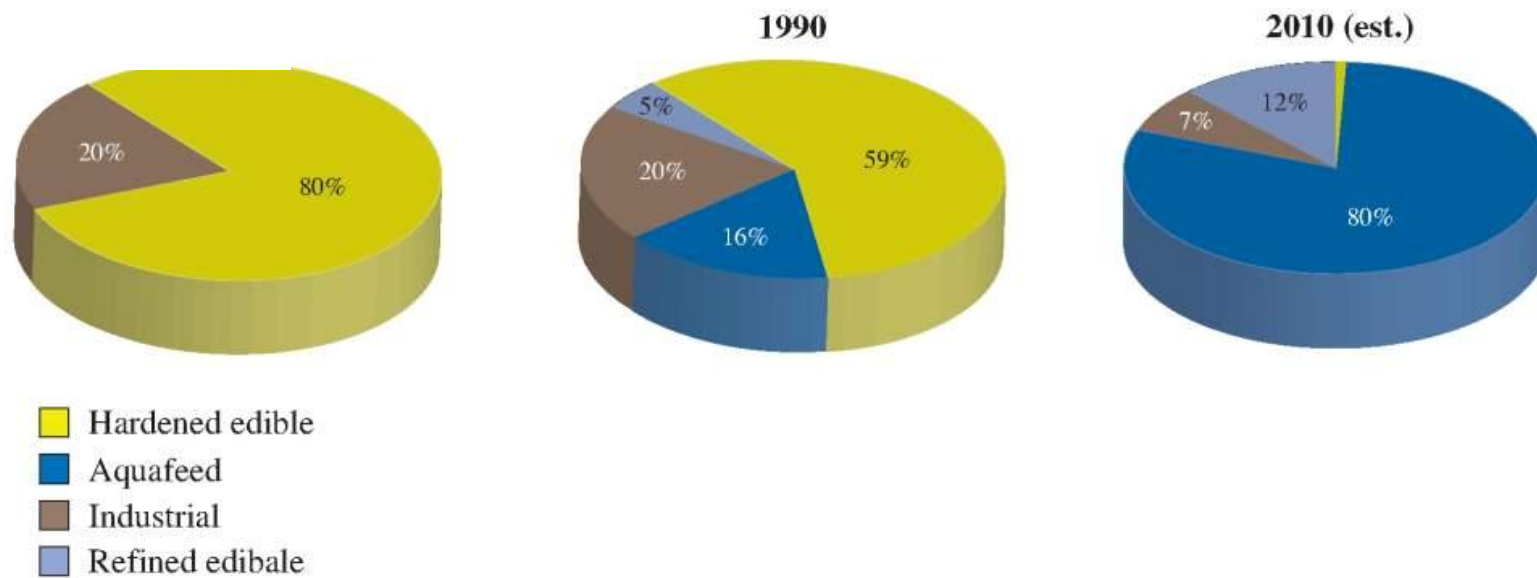


*Available
volumes
of marine oil:
Approx 1 mill
tones*

Source: FAO

Changing use of FISH OIL

Changing uses of fish oil

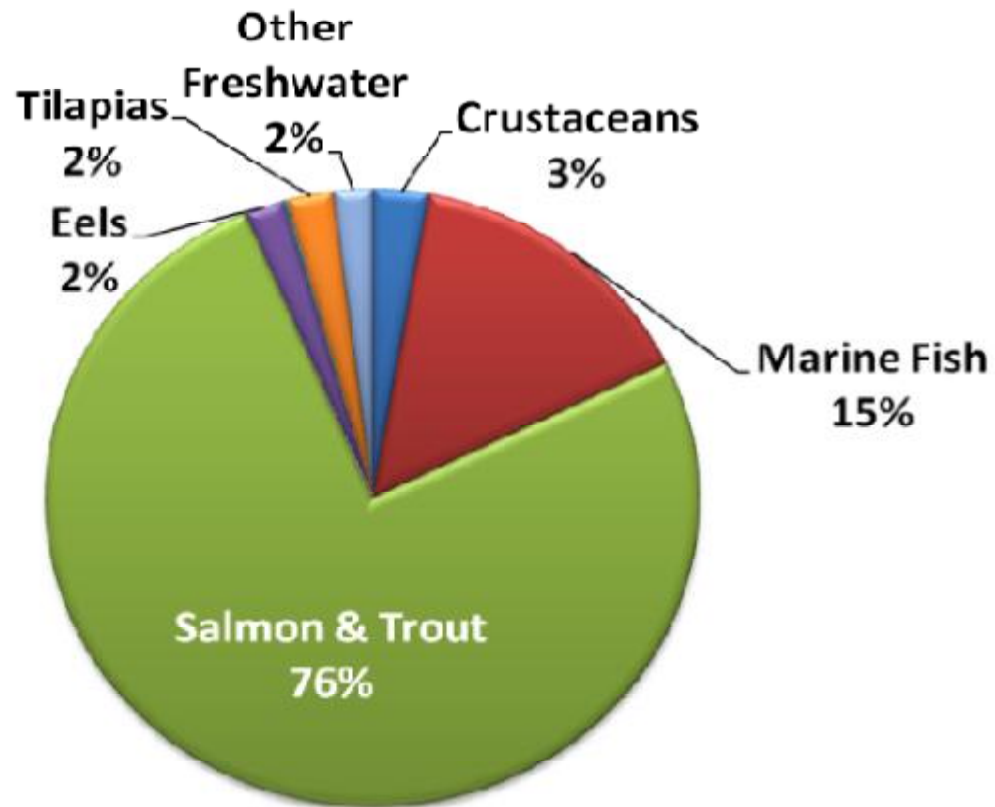


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Use of FISH OIL in Aquaculture 2008

Use of fish oil in Aquaculture 2008

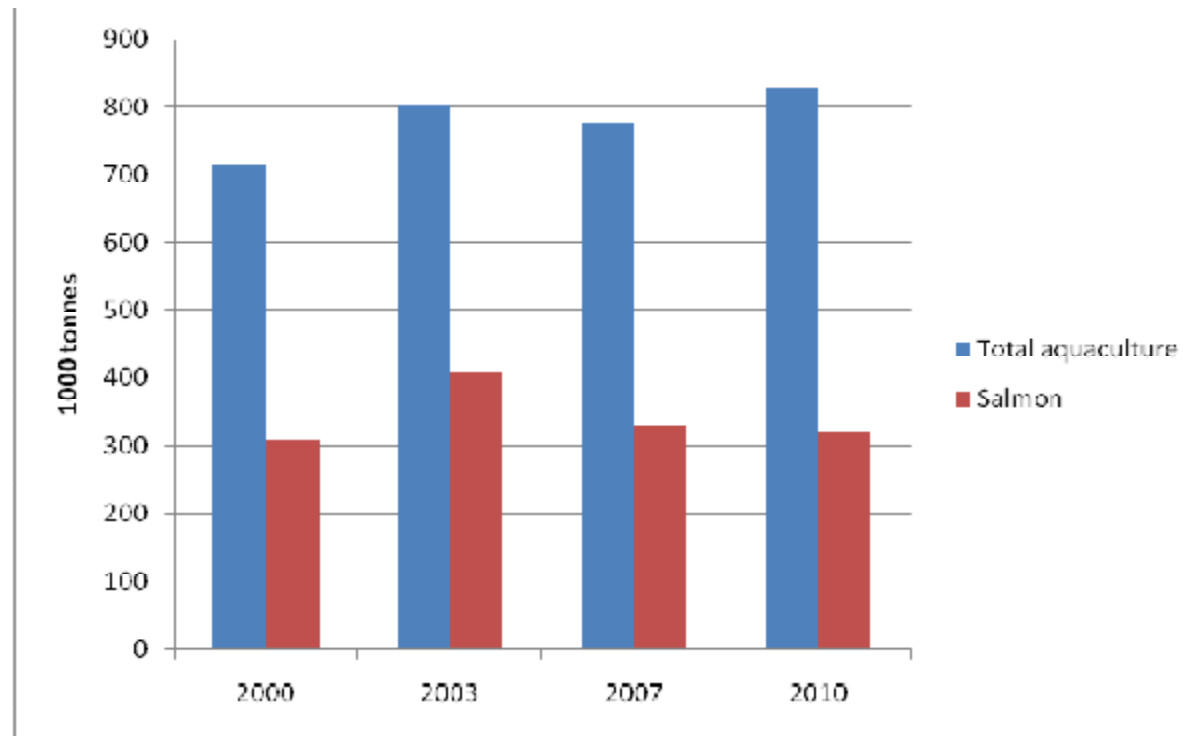


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Aquaculture, of which 40 % salmon, consumes the great majority of marine oils

Marine oils consumed by total aquaculture and salmon



Source: IFFO estimates in Tacon & Metian, 2008

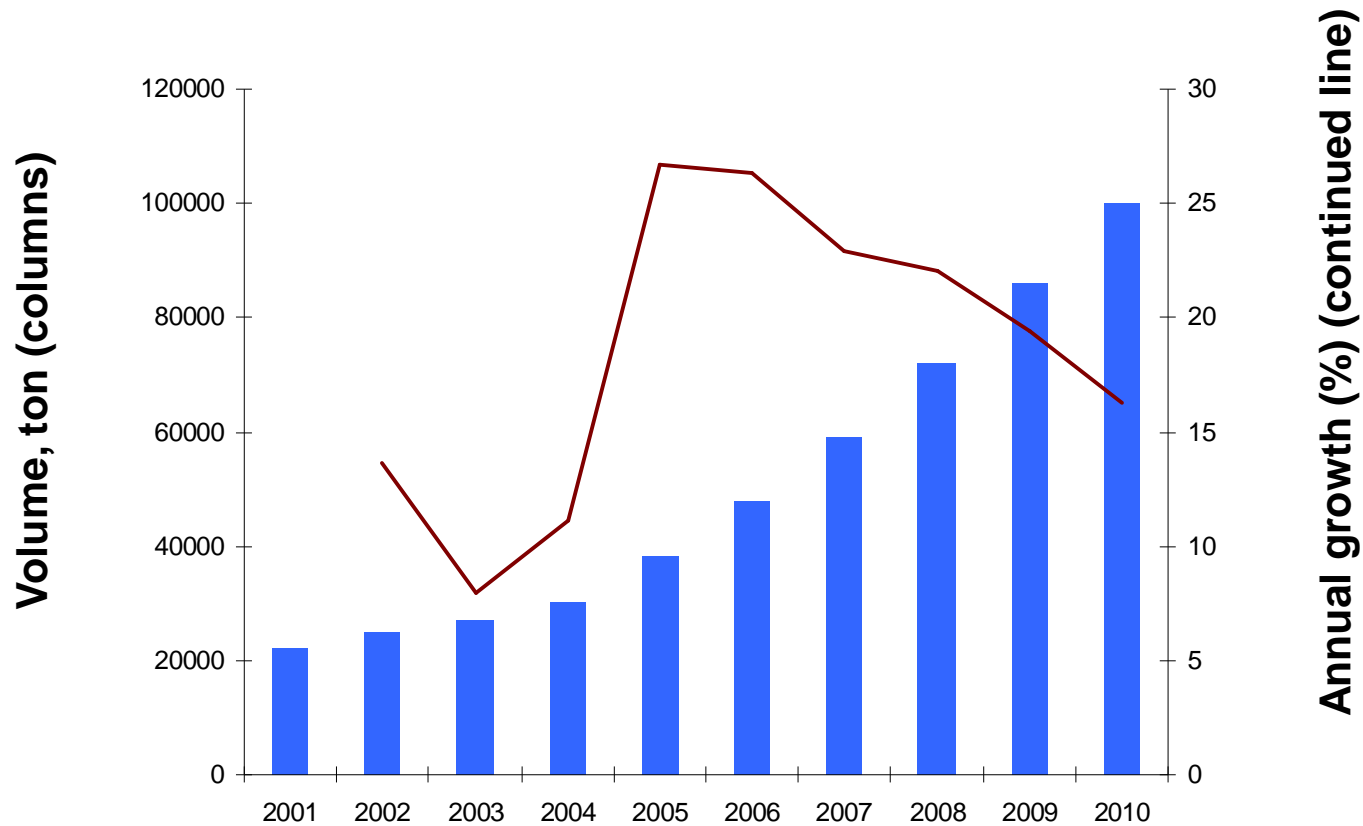


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Nutritional supplements crowd out aquaculture

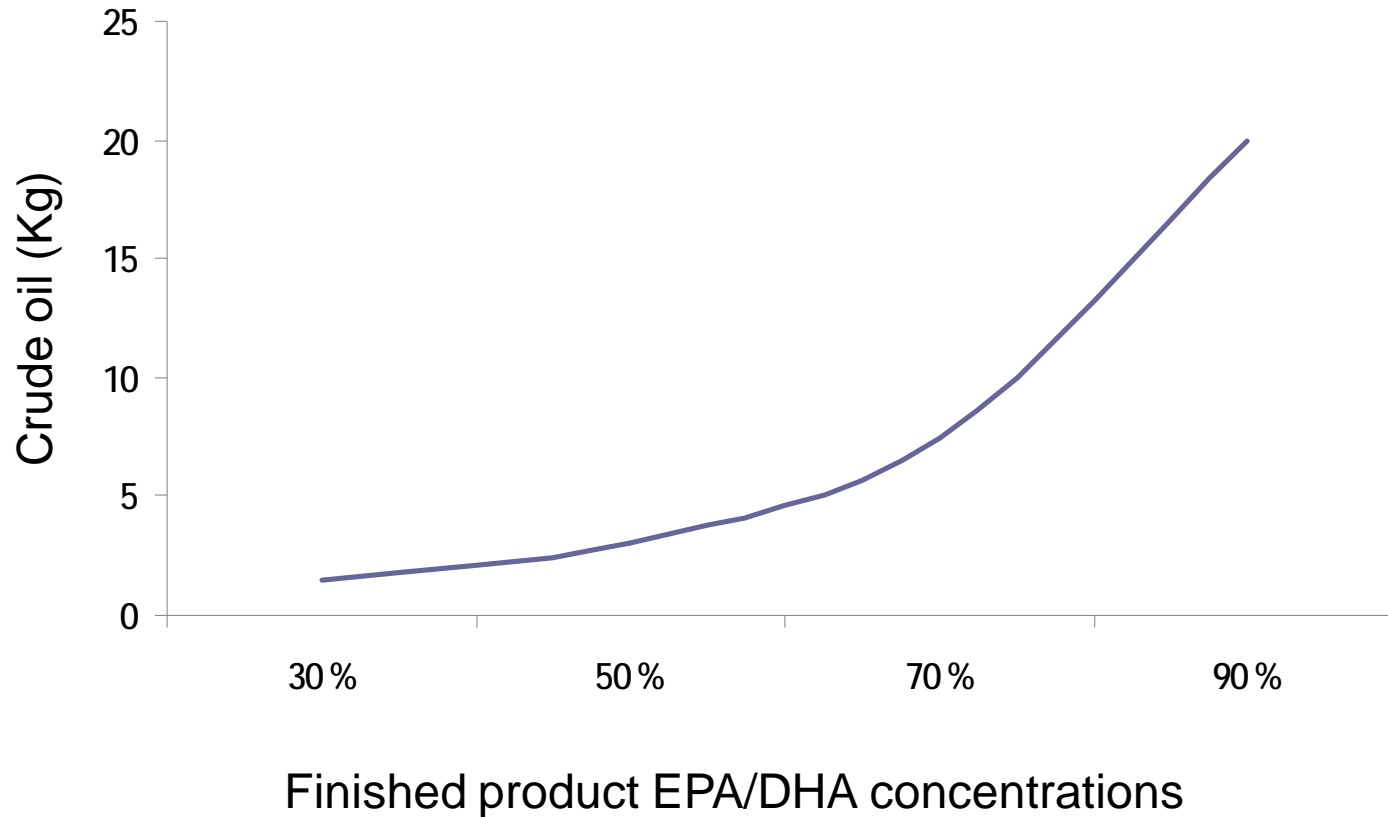
The global market for refined Omega 3 marine oil



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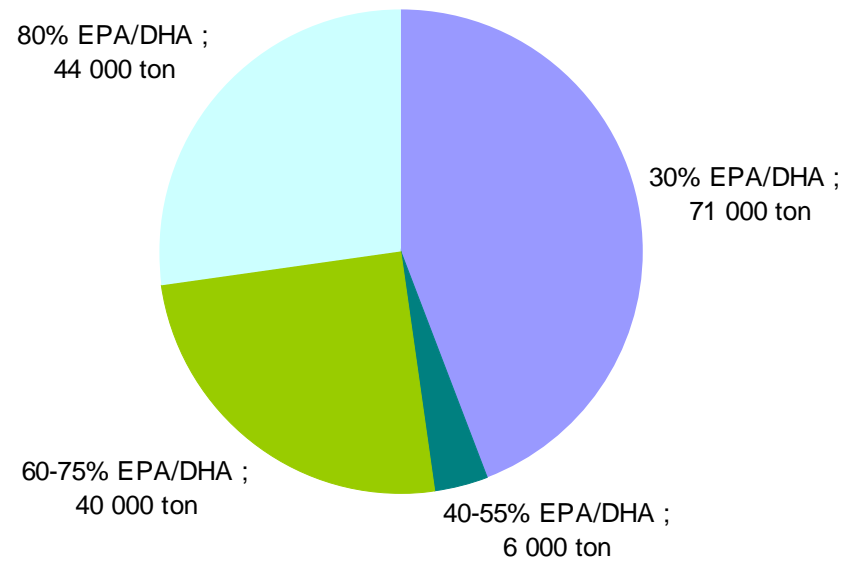
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Rising rates of concentration in refined products, will greatly stimulate demand



Source: GOED, 2010

Distribution of crude oil in 2010

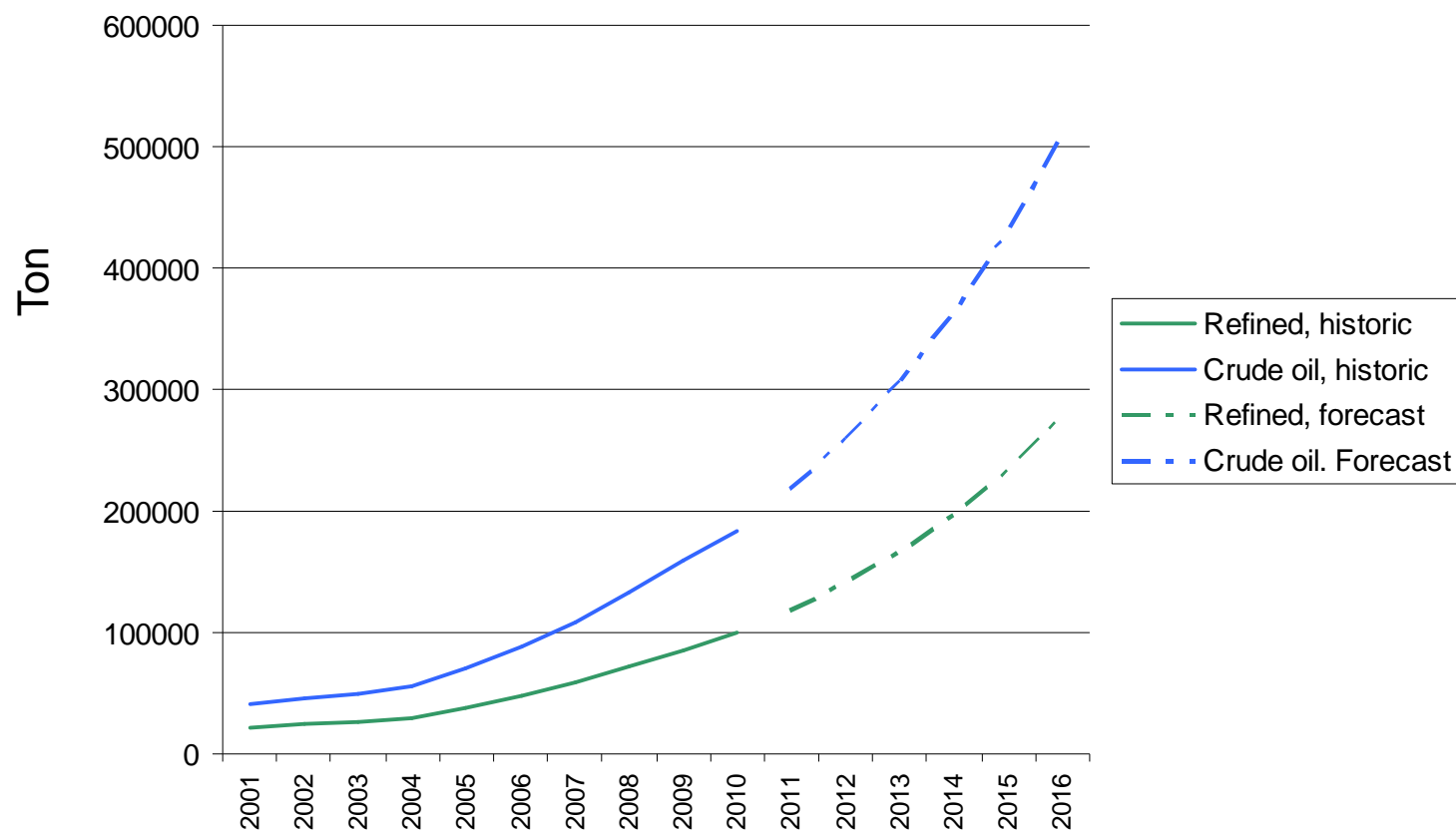


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The effect of continued fixed growth rates in the demand for refined marine oils for human consumption

Illustration

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Lysbilde 11

KSt1

Kanskje fjerne dette lysbilde?

Kjell Staven; 10.04.2011

Three scenarios for future use of fish oil

Underlying assumptions:

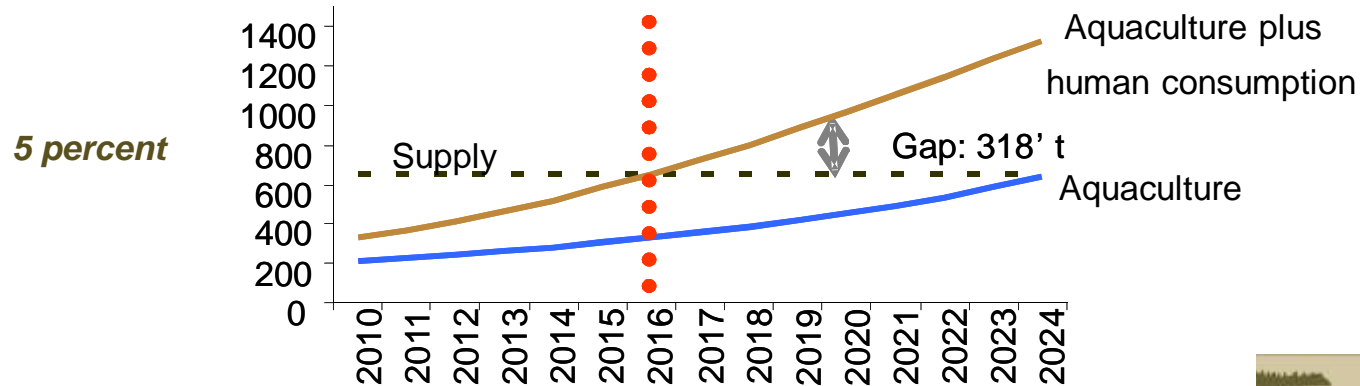
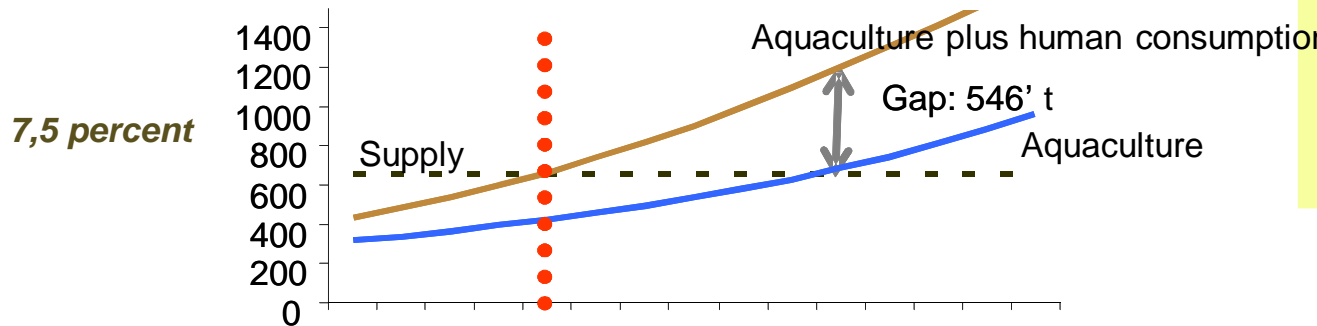
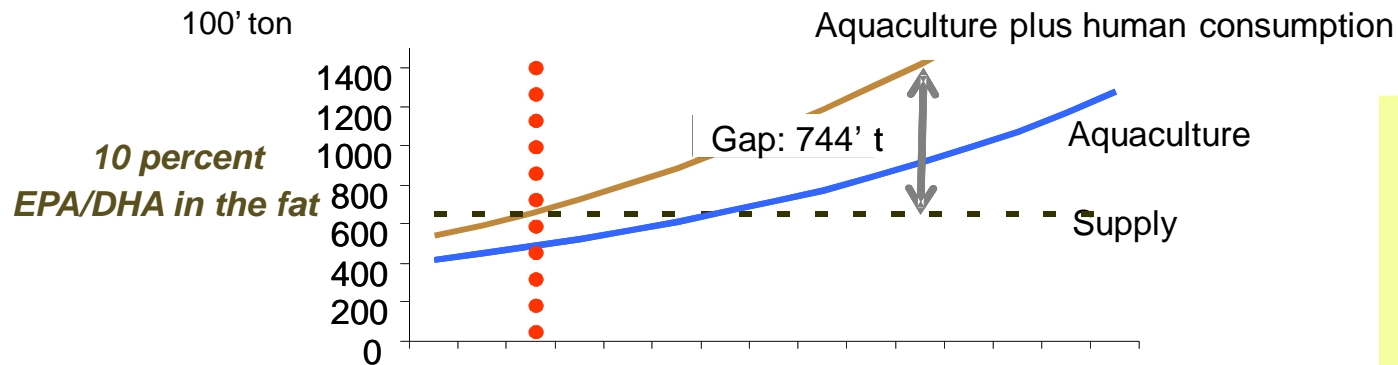
- Current need for feed: Approx 2,4 mill tones, 5 % growth per year implies 3,9 mill tones in 2020.
- Current standard for salmon feed: 10 % EPA+DHA
- Nutritional supplement
 - Currently 120 000 ton
 - Annual growth of 17 % next 3 years, falling to 7 % over the following seven years.
 - Demanding 3-400 000 tones in 2013
 - Picking the most Omega-3 rich fractions
- Available marine oils for aquaculture holds less EPA /DHA over time: From 20 % EPA/DHA to 15 % over ten years.



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Undercoverage and severe increase in substitution can arise quickly



10 % EPA/DHA in the fishfeed, the industry has 2-3 years to find new solutions. A reduction in EPA/DHA to 7,5 %, the industry gets additional two years. Halving, from 10 to 5 % EPA/DHA, the critical undercoverage be moved to 2016.

Current wisdom: Further substitution possible

- *No fish health problems related to feed component substitution*
 - Even towards 3 percent marine fat.
 - Taste and smell is robust.
 - However: Limited experience and research over time.
- *Shifting fat – protein ratios may further enhance the potential for substitution*
 - Regulations stimulate rapid growth in biomass – high protein contents.
 - More flexible feeding may lower the need for fish oil.
- *Labeling regulations provide wide room for substitution.*
 - The label “Source of omega-3 fatty acids” requires only 40 mg EPA+DHA, or 300 mg ALA, per 100 g and 100 kCal.
 - “High omega-3 fatty acids” requires only 80mg EPA+DHA, or 600 mg ALA, per 100 g and 100 kCal.
 - Both label provides room for very low contents of Omega- 3
- *No facts proving severe consumer response to shifts in feed content.*
 - Important risk factor
 - Marketing is critical
 - Limited research.

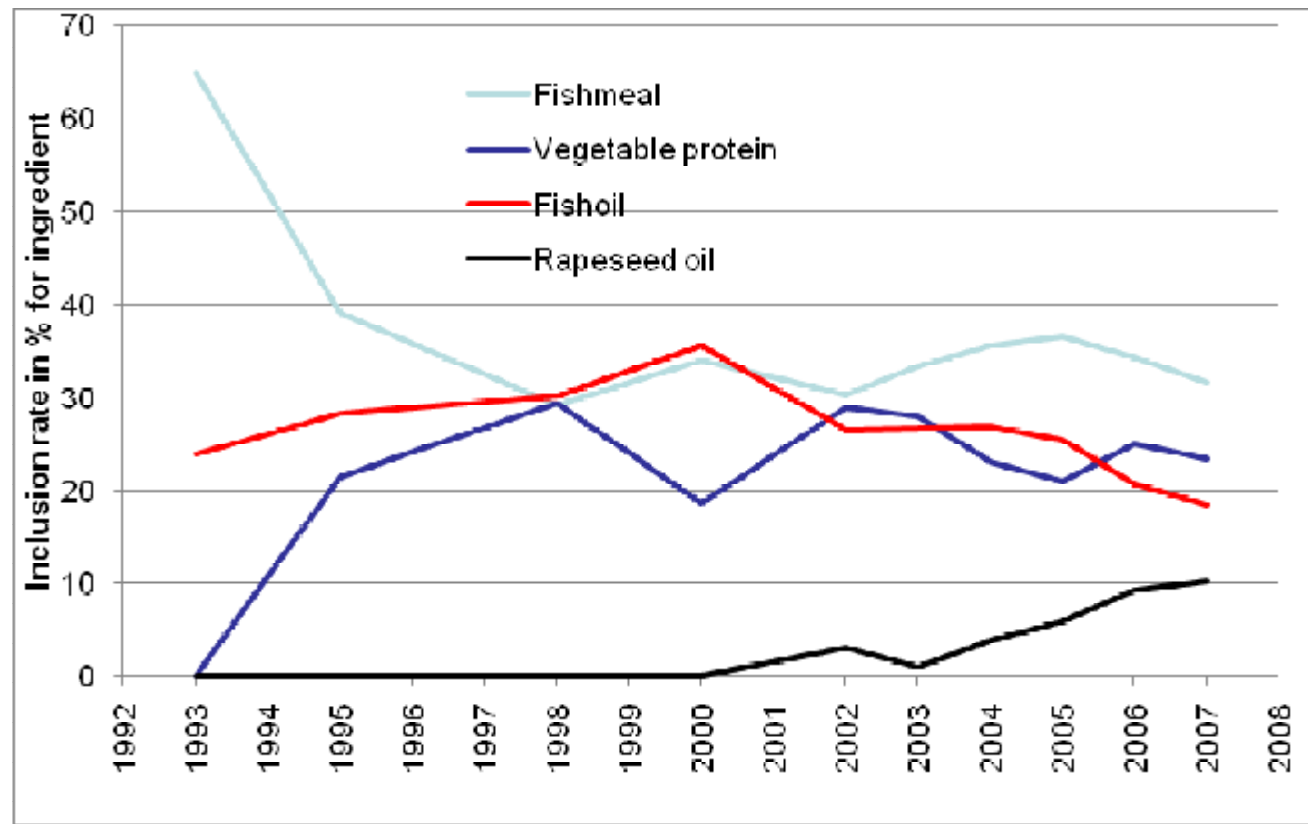


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Increased substitution, the experience

Historical development, inclusion of different ingredients in typical salmonfeed in Europe



Source: Skretting

A different Salmon Industry

- Higher, more volatile feed costs
- Hunting new sources for Omega 3

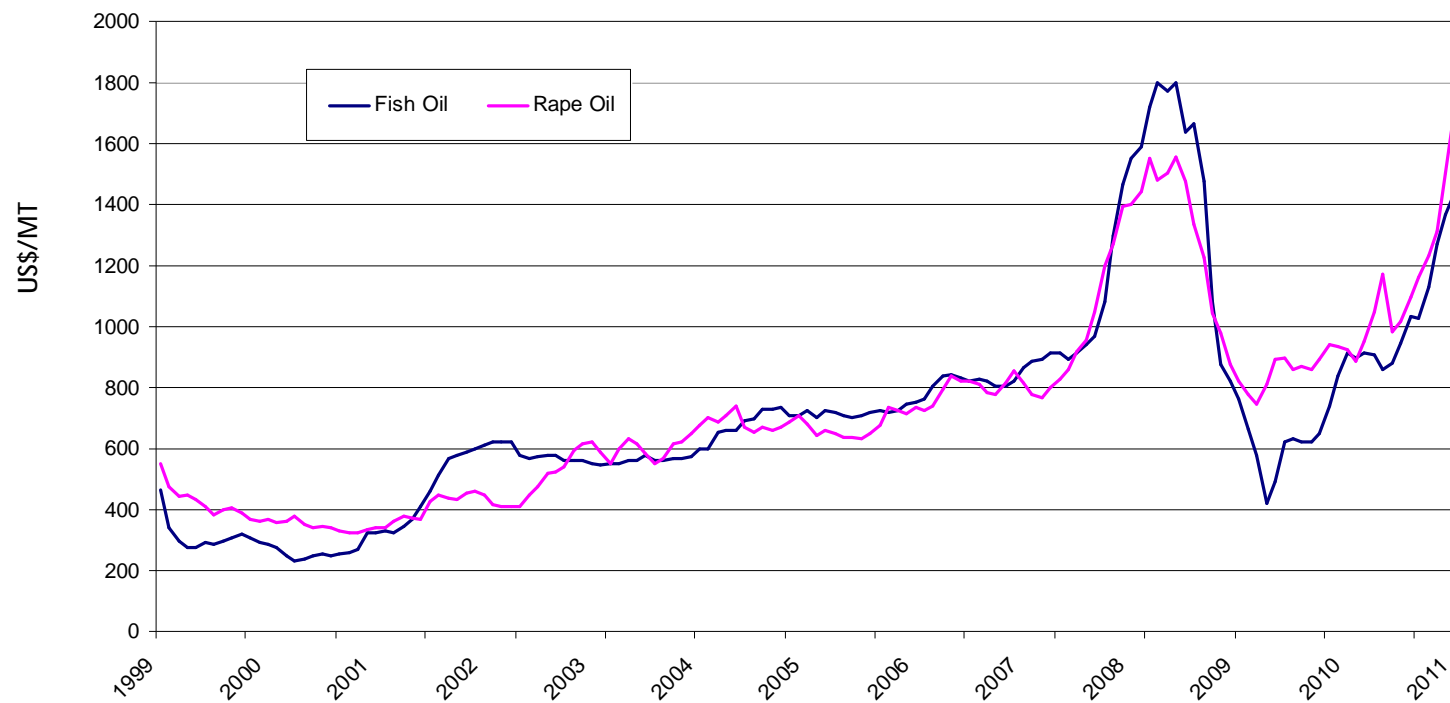


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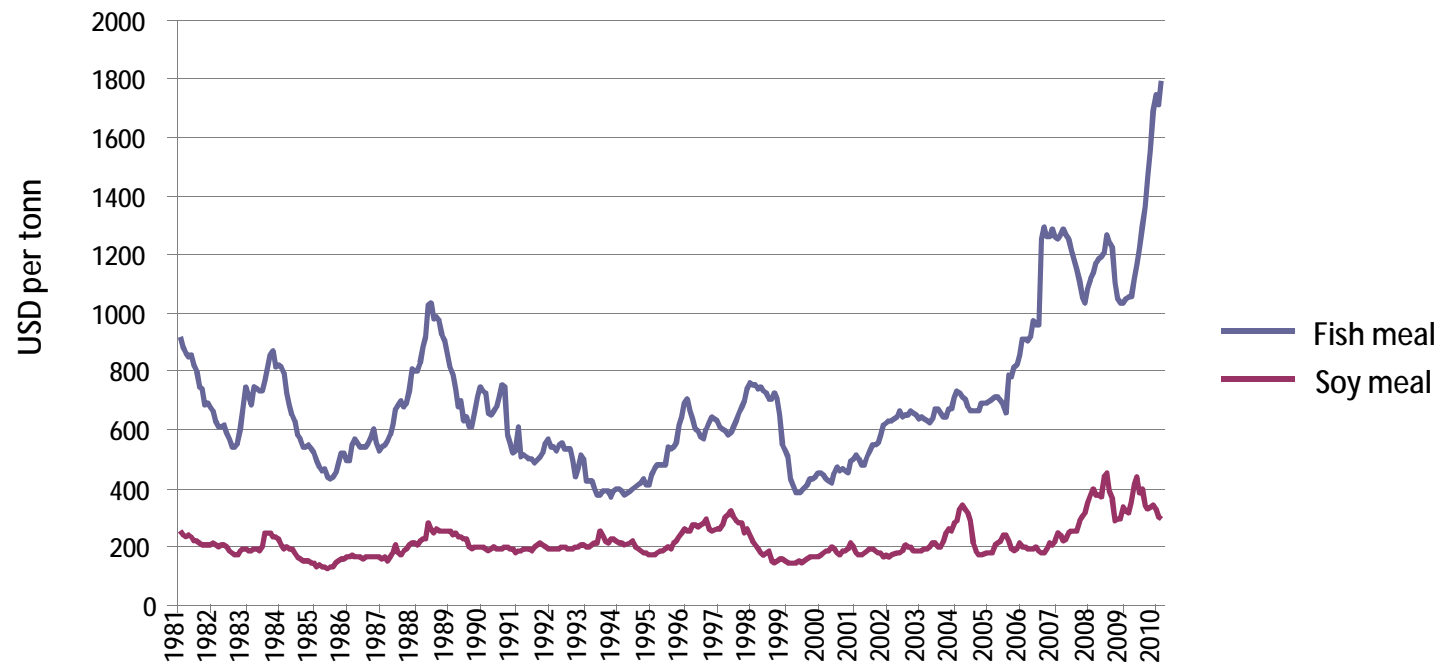
Higher, more volatile prices

- Increased volatility in fish oil prices and rapeseed oil prices
- Parity between the dominating rapeseed oil and marine oil so far
- Shortage will mean a substantial leverage on marine oils compared to rapeseed oil
- Omega 3 will then be priced separated from its general fat content



Higher, more volatile prices

- Inelastic demand ensures volatility if there is variation in supply
- Learn from the relation between fish meal and soy meal



New omega-3 sources

- Krill
- Algae
- Calanus
- GM oil



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Intensive chase on new sources with omega-3

Krill:

- Small volumes
- Possibilities for relative rapid growth.
- It is not yet of interest to market krill oil for fish feed production, because of the premium in the market of human consumption
- Today; possibilities for the fish feed industry to buy krill meal with high content of fat

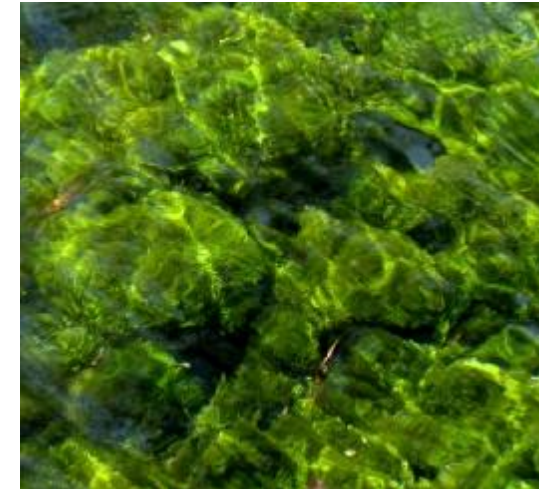


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Algae – fermentation: Expensive with great potential:

- Algae-fermentation has probably an indefinite volume potential
- At the present prohibitive costs.
- Using algae in the fish feed is possible, but there are differences between species and some species must be treated before use



Calanus : Norwegian resource with potential

- Potential as a substitute up to 40 percent of the fat in salmon feed.
- Great potential in volume. It is claimed that the production of zooplankton in the Norwegian ocean is about 350–600 millions ton per year.



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Intensive chase on new sources with omega-3

GM- omega-3 oils from rapseed oil or soybeen oil:

- The development of GM-oil is very expensive and time consuming
- Uncertain when it can be available on the market, but oils with both EPA/DHA might be available in about ten years

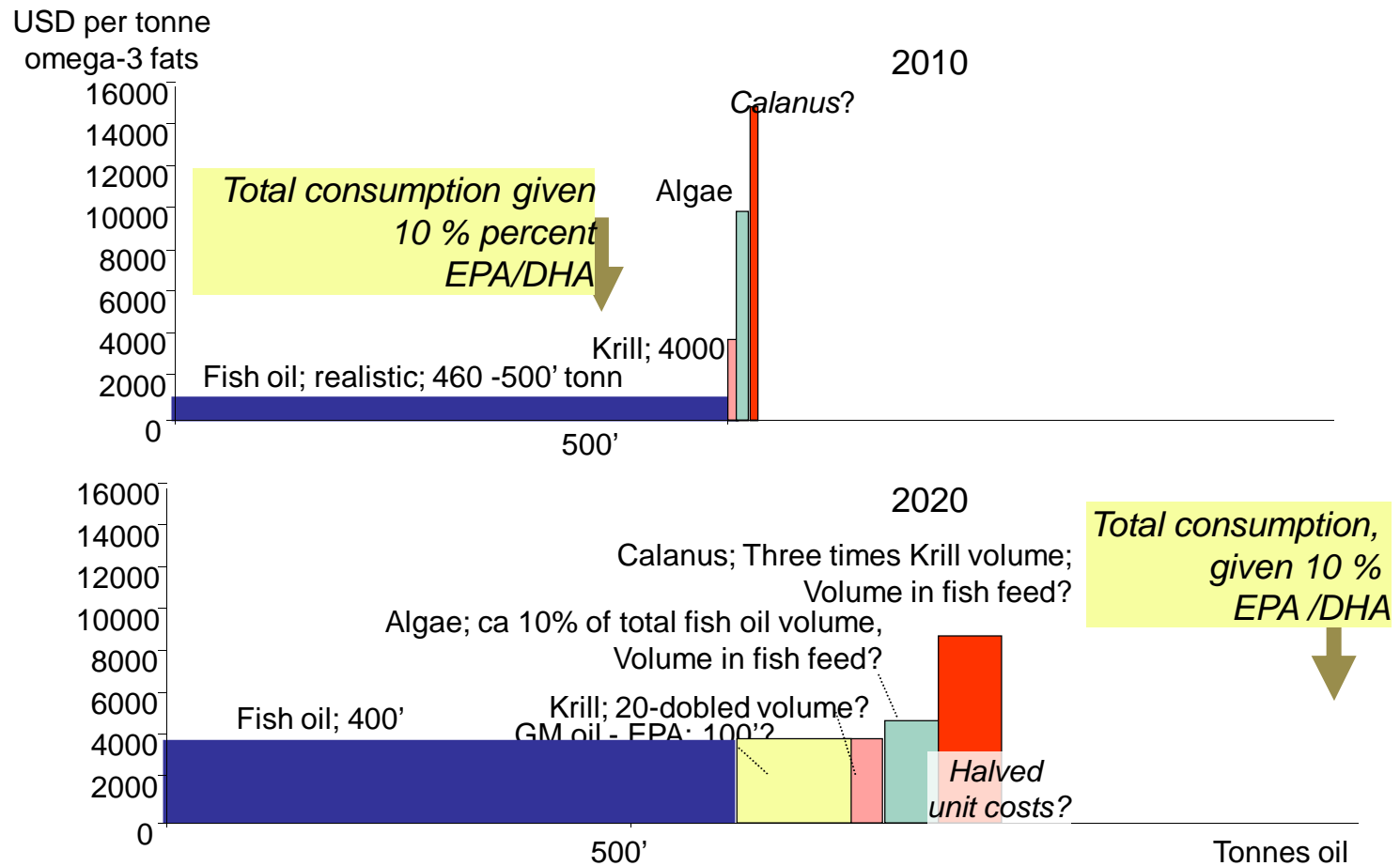


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..no sufficient source in sight

Illustration of a tentative supply curve; 2010 and 2020.



Summing up

- The amount of fish oil is limited
- Fish oil to human consumption will increase
- Comprehensive research
 - Consumer preferences and behavior
 - Potential for substitution in feed
 - Availability of Krill, algae and Calanus



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