ProAlgae2013

Industrial production of marine microalgae as an EPA- and DHA-source for use in fish feed

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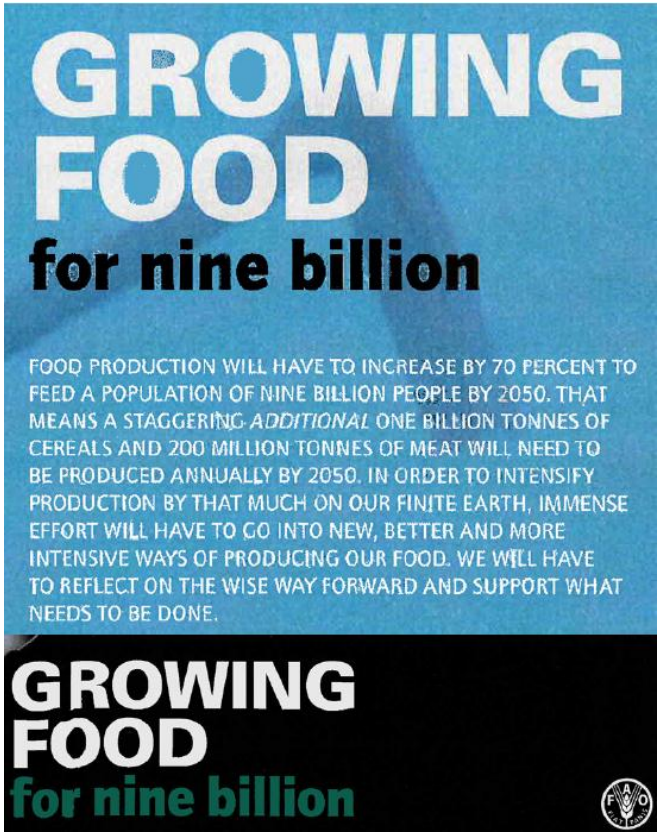
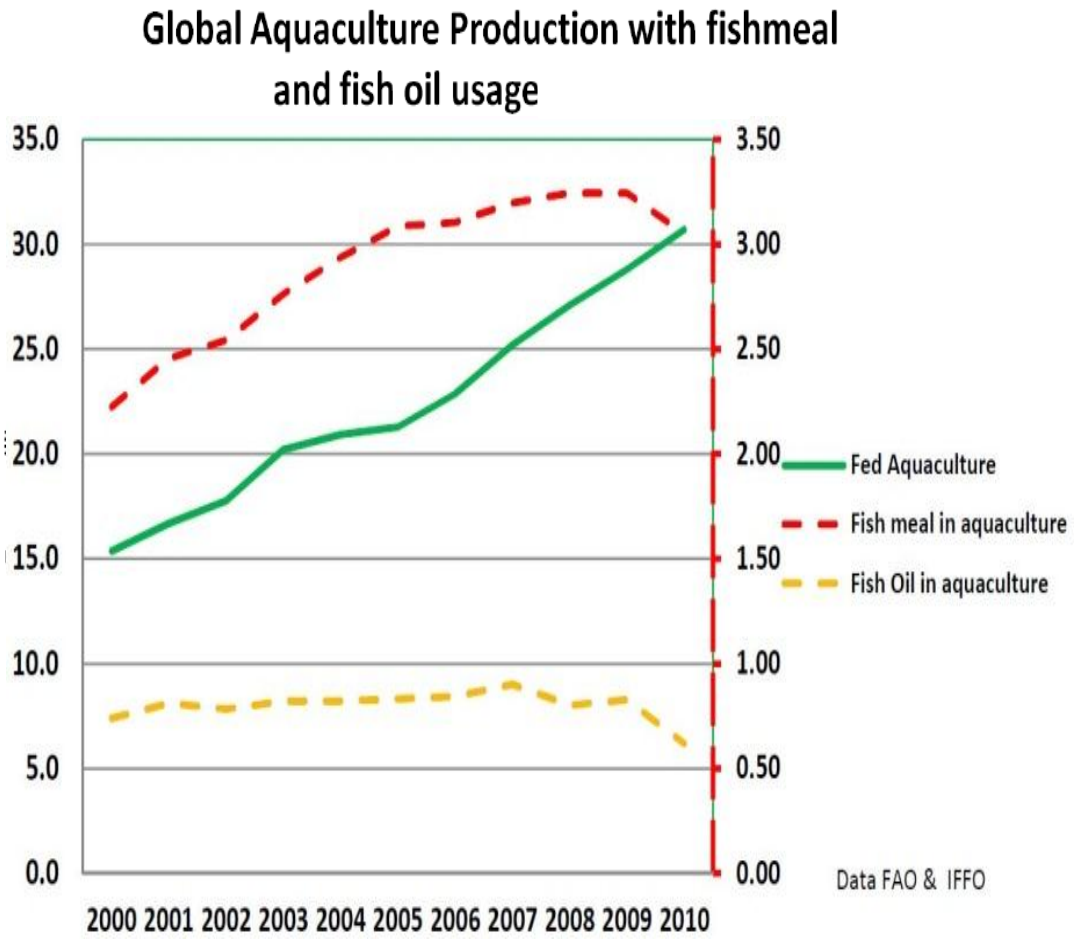
The Research Council of Norway

The ProAlgae project

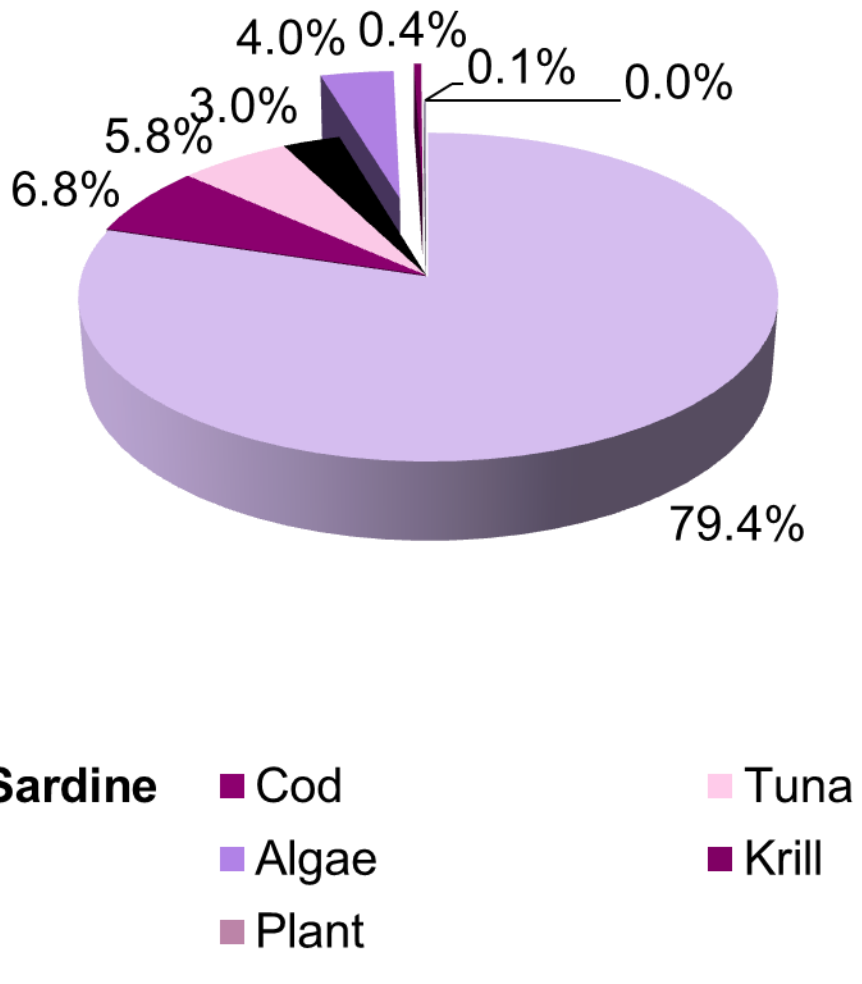
- Background - *why*
- Aims - *what*
- Methodology - *how*

Limited sustainable feed resources





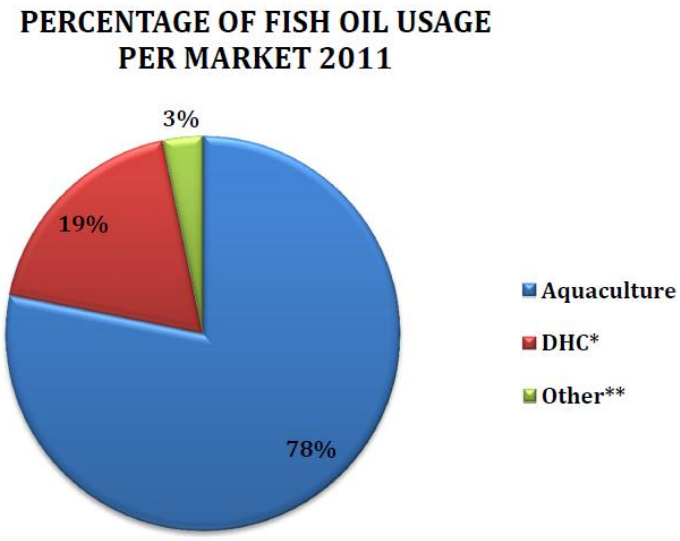
Limited sources of refined Fish oil



Source: GOED

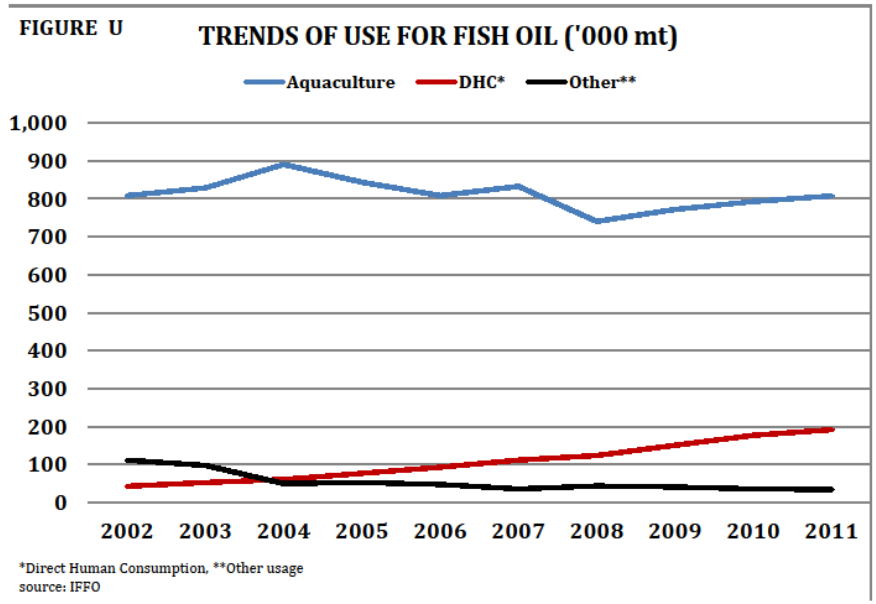
Increased direct human consumption

FIGURE T



*Direct Human Consumption, **Other usage

FIGURE U



*Direct Human Consumption, **Other usage
source: IFFO

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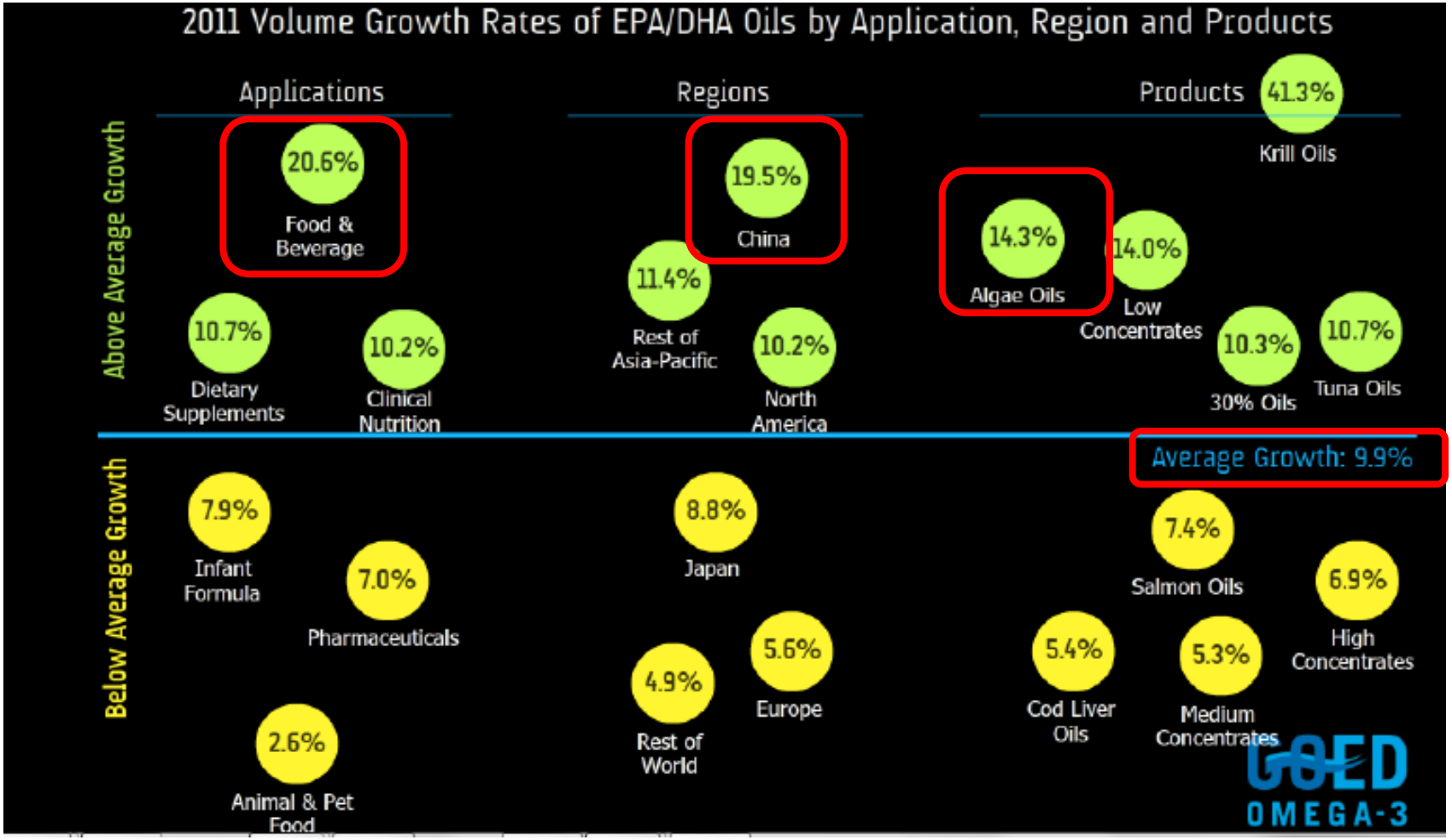
Source: IFFO

Emerging applications of omega-3 fatty acids



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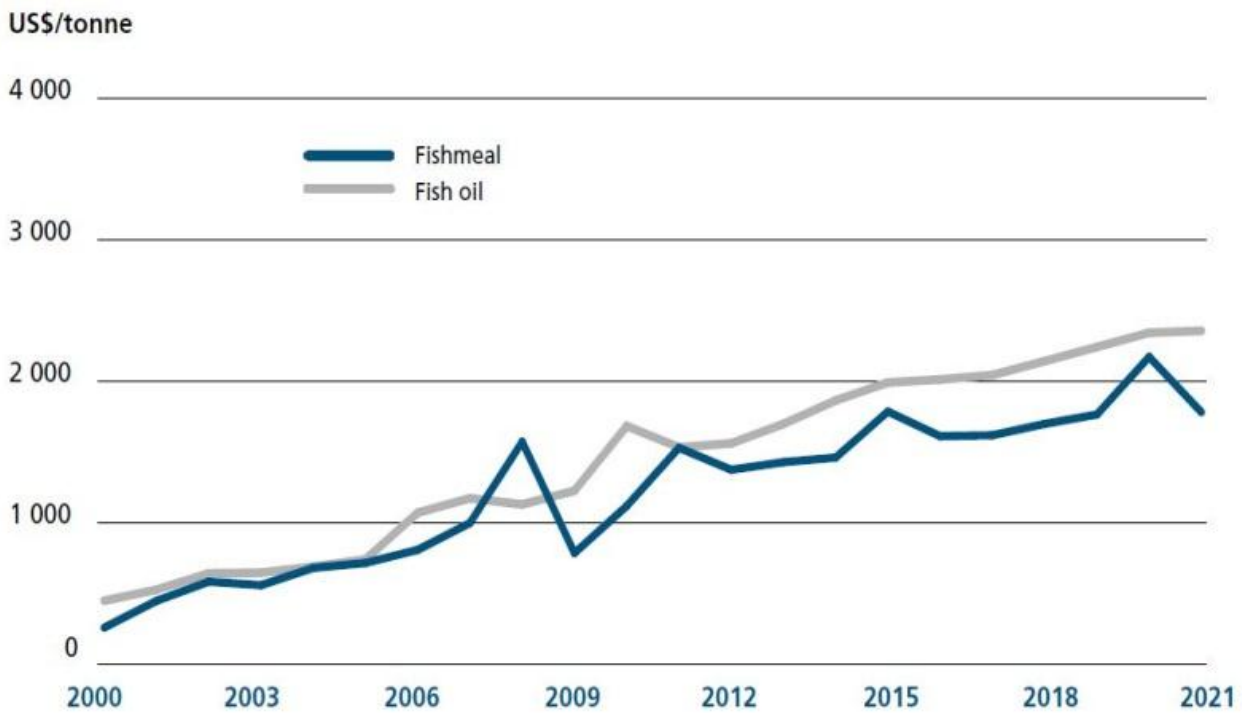
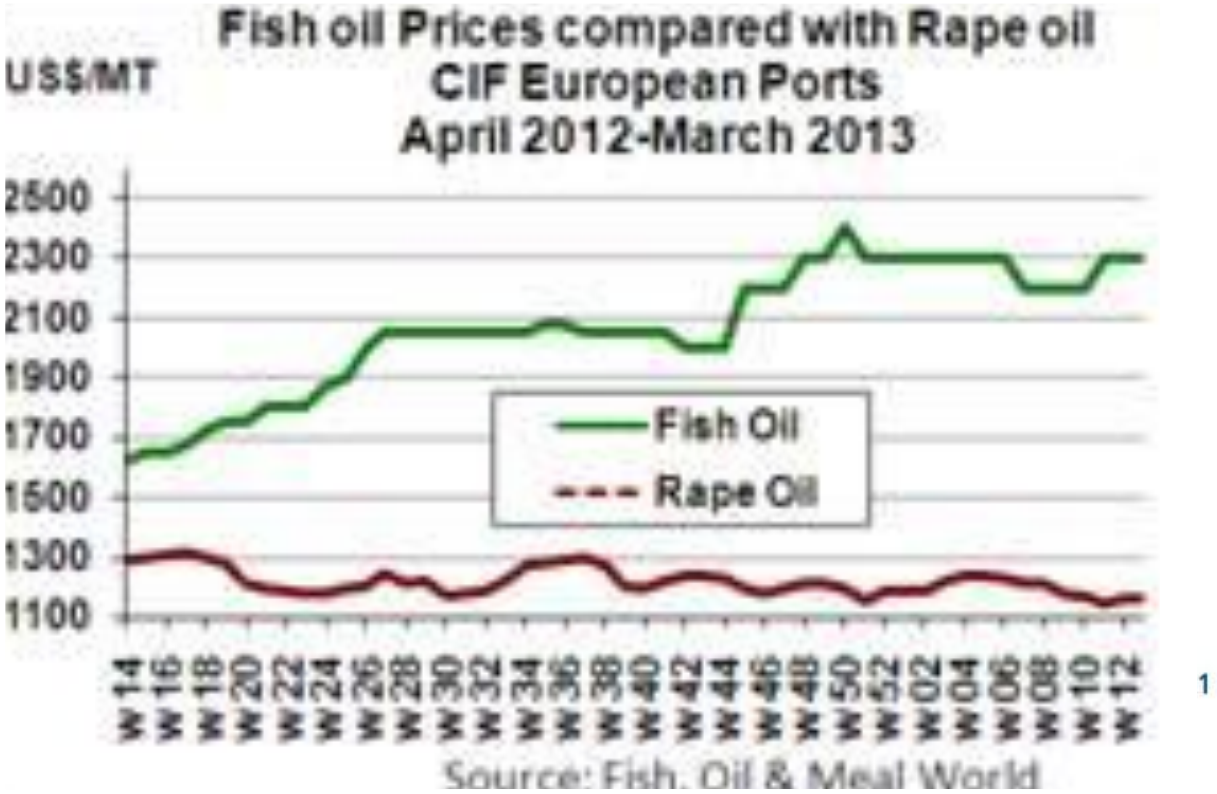
Source: A. Mallison, GOED

Fish oil price are expected to increase

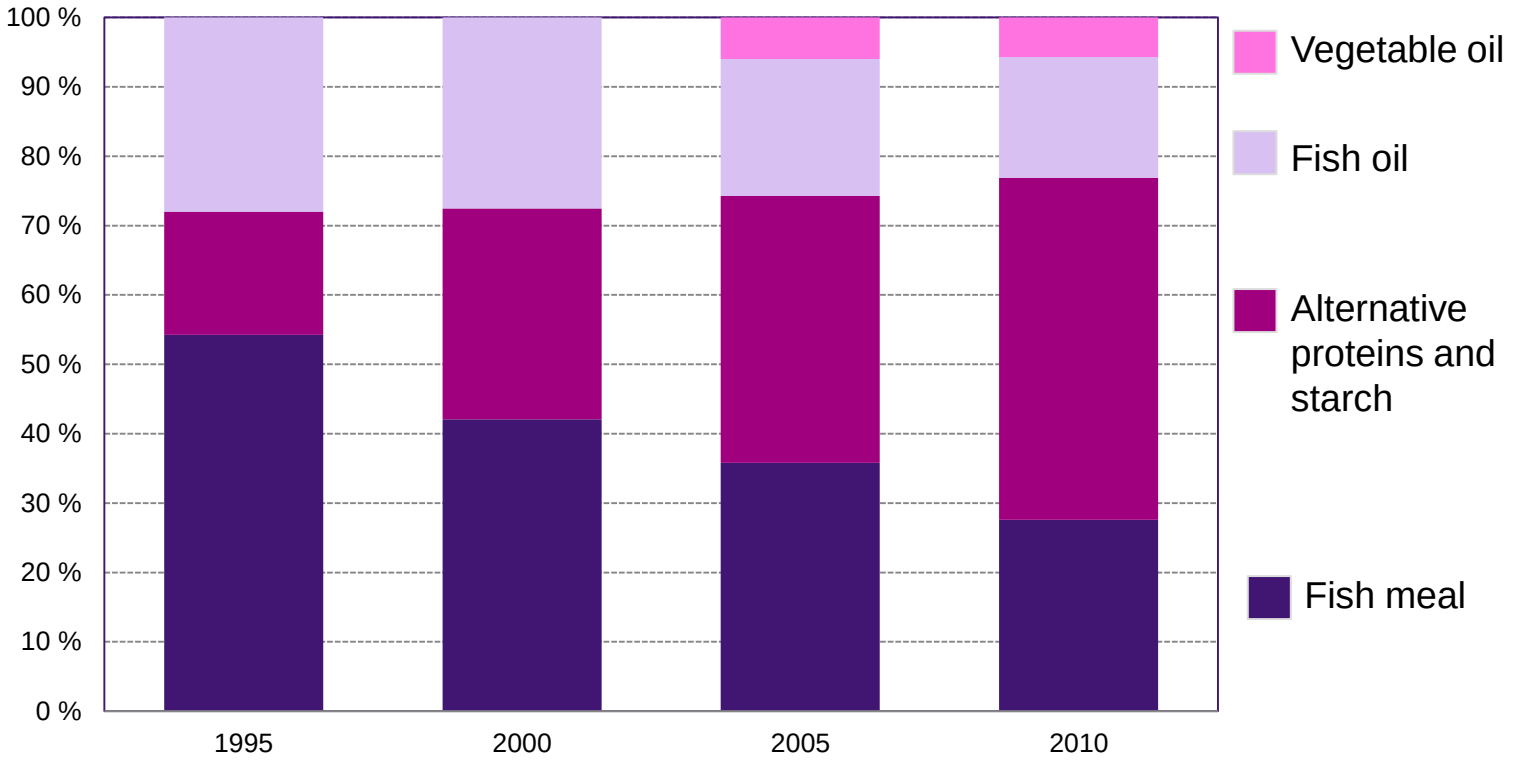


UN FAO Aquaculture and Fisheries, 2012

FO price is affected by limited supply



Fish oil is a vital ingredient of salmon feed



- Vegetable sourced replacements increase
- EPA and DHA contents reduced significantly in feed
- Omega-3 levels in marketed salmon reduced

Source: IFFO

Managing the shortfall - exploring replacements

- Joint aquafeed industry report
  - *Limited pelagic supply*
  - *Increased DHC*
  - *Dramatic shift 2014*
  - *2017: 4 mill t salmon feed needed*
- Strategic decision point
- Choice of alternative EPA&DHA sources will depend on:
  - *Fish oil price development*
  - *Prod. costs and cost development*
  - *Technical feasibility*
  - *Sustainability*
  - *Consumer acceptance*

Alternative omega-3 sources for aquafeed

Commercially Available

In Development

Fish

Anchovy
Sardine
Mackerel
Tuna
Cod
Salmon
Menhaden
Trout
Pollock
Hoki
Halibut
Sandeel
Angelfish
Saithe

Squid

Market Squid
Argentine
Shortfin Squid

Zooplankton

Antarctic Krill
Pacific Krill
Northern Krill

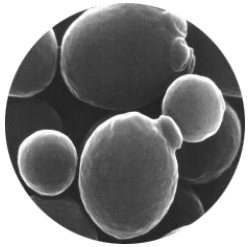
Growing volumes
< 5000 t by 2017
Niche market

Algae

Schizochytrium
Crypthecodinium
Euglena

DuPont production
GM yeast 55% EPA
GM salmon feed
Used in Verlasso salmon
GM fed salmon on US market

Fungi

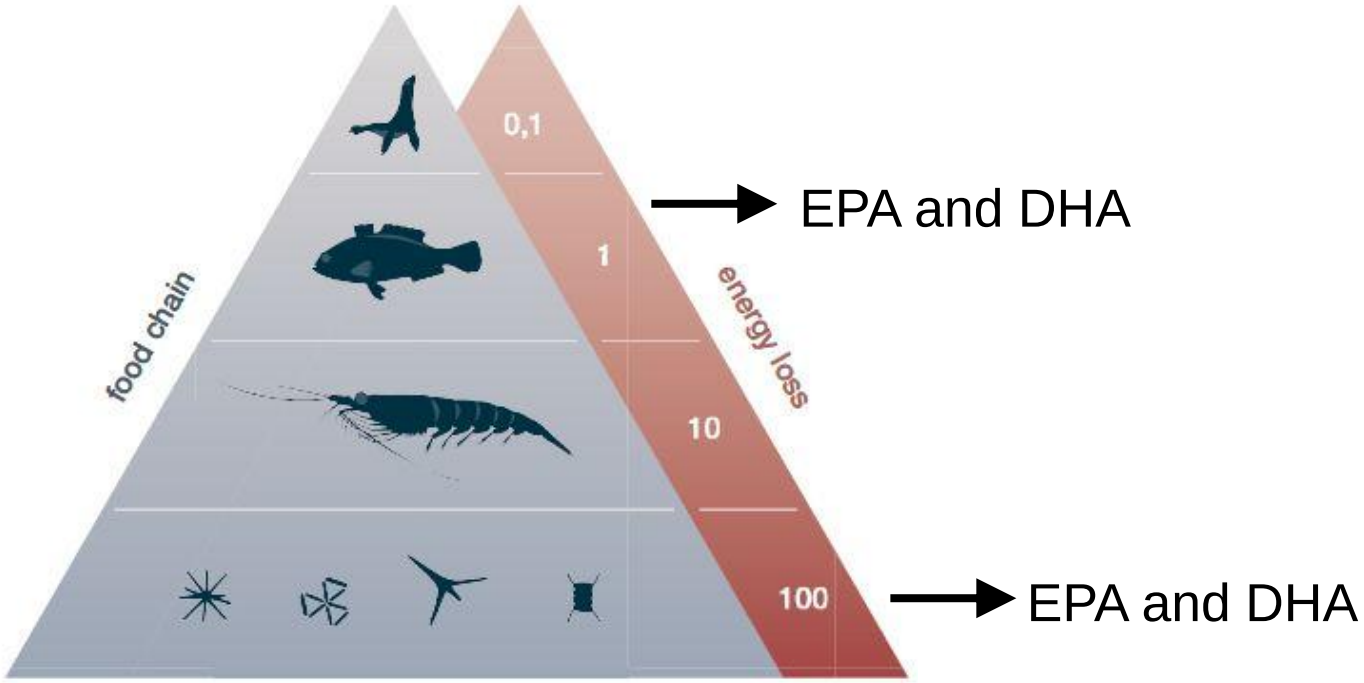


Y. Lipolytica

GM Plants

Stearidonic Ω-3 (SDA)
DHA&EPA up to 20%
Several years away
Still low productivity

Sustainable sourcing



- Sourcing the lower trophic biomass
- Avoid 90% energy loss between levels

Norwegian Seafood Research Fund

Project invitation to develop:

A "state-of-the-art" report describing the international knowledge status on production of marine microalgae, at relevant industrial scale and as a raw material in feed – intended as a base for decision making.

ProAlgae

Industrial production of marine microalgae as an EPA- and DHA-source for use in fish feed

Aims:

- "State-of-the-art" report of the international status of knowledge on industrial production of marine microalgae.
- Describe the possibilities to produce EPA and DHA in microalgae for use in feed at an economically viable cost.
  - *Investigate scientific knowledge basis, with emphasis on the potential and limitations*
  - *Identify future research needs and possibilities to develop a commercially viable production to support aquafeed production.*

Norwegian Seafood Research Fund - FHF

ProAlgae (2012-2013)

Project owner

FHF

Steering group

SKRETTING

EWOS

BioMar

Reference group

Key research competence

Industrial competence

Project group

uni Research
Centre for Applied Biotechnology

SINTEF

Method

Part 1 – Assessment of status and opportunities

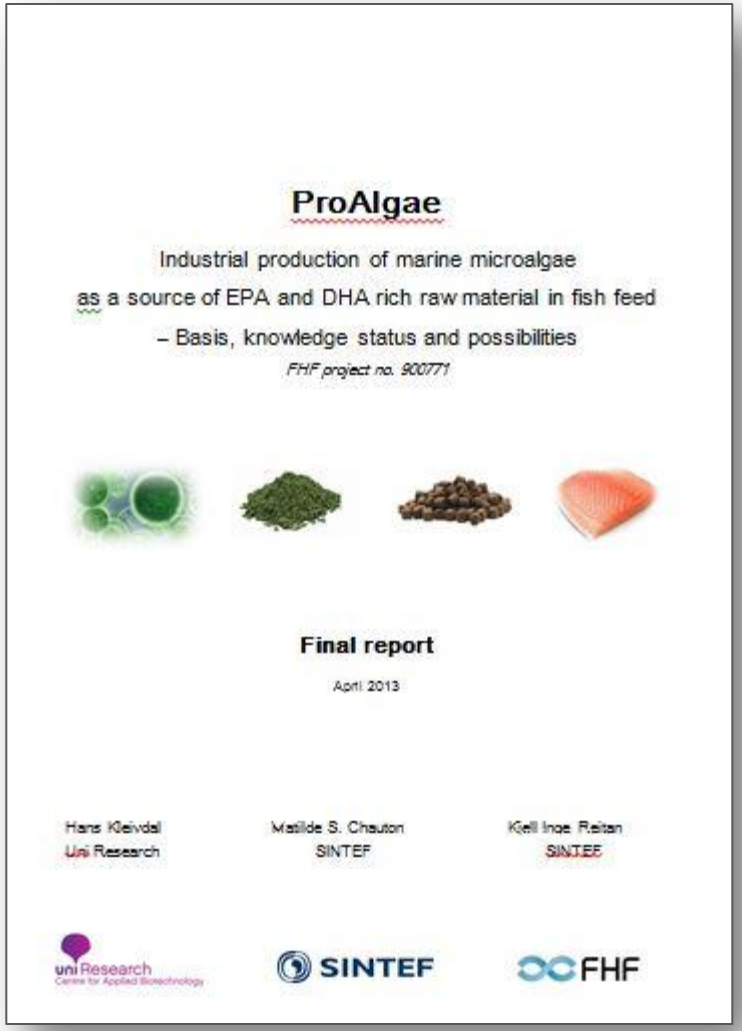
- Input from the steering committee
- Workshop with reference group.
- Describe international status and opportunities (visits and meetings)
- Preliminary results to the steering committee

Part 2 – Assess the scientific basis, research needs and opportunities

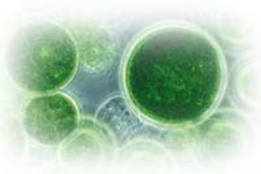
- Collaborative investigation with contributions from the reference group
- Dissemination: Report and open Workshop

ProAlgae Reference group

The ProAlgae report



The biology potential



Algae production

Processing and feed development

Application

Algal metabolism

Biodiversity
Selection
Optimization

Growth conditions
Bioengineering

Upscale

Harvest
Dewatering
Processing

Feed development & formulation

Feeding trials
Documentation

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