



Calanus AS: New bio-industry based on the marine copepod *Calanus finmarchicus*

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ICES meeting 11052016



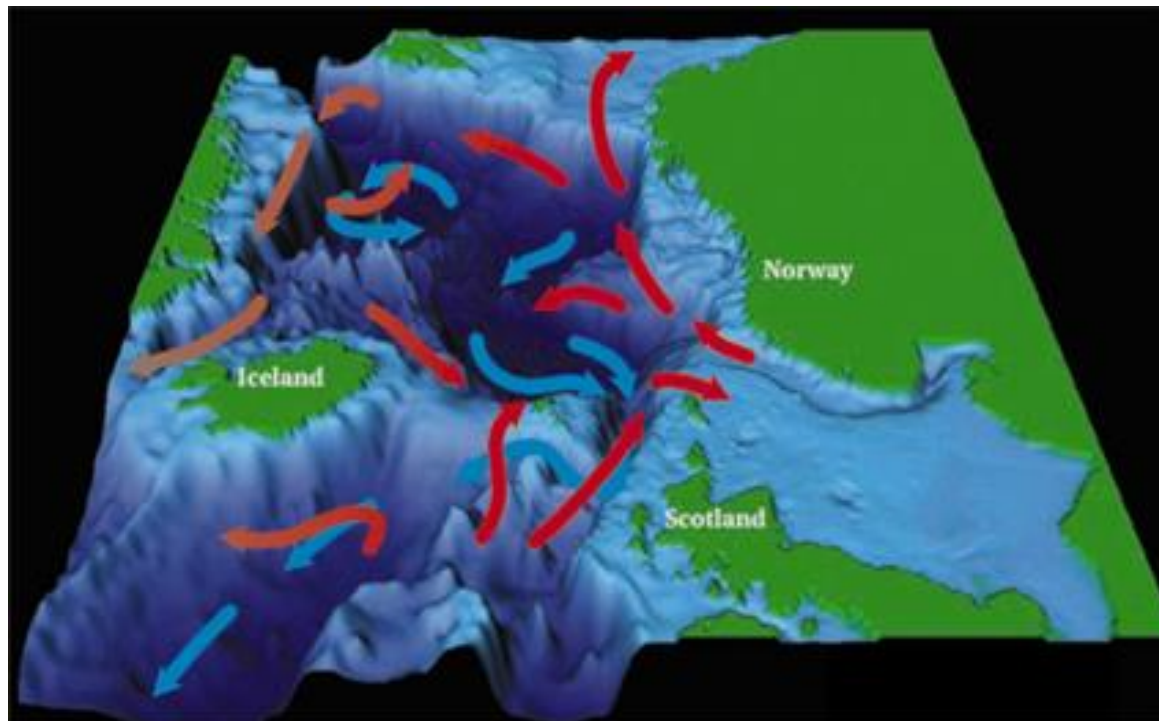
Calanus AS:

- Private Norwegian company developing new bio-industry on the marine copepod *Calanus finmarchicus*, the largest renewable and harvestable resource in the North-Atlantic Ocean.
- First-mover covering the whole value-chain, but with focus on human health and nutrition products including a novel marine oil with unique properties («third-generation omega-3»).
- The company has documented that *Calanus finmarchicus* may be harvested and utilized for valuable products in an ecologically and economically sustainable manner.
- Main product Calanus® Oil launched in Norway and the USA (Arctic Ruby® Oil) in late 2012, with good response.
- Other products/markets: Protein ingredients for food, starter feed for aquaculture and pet-food.

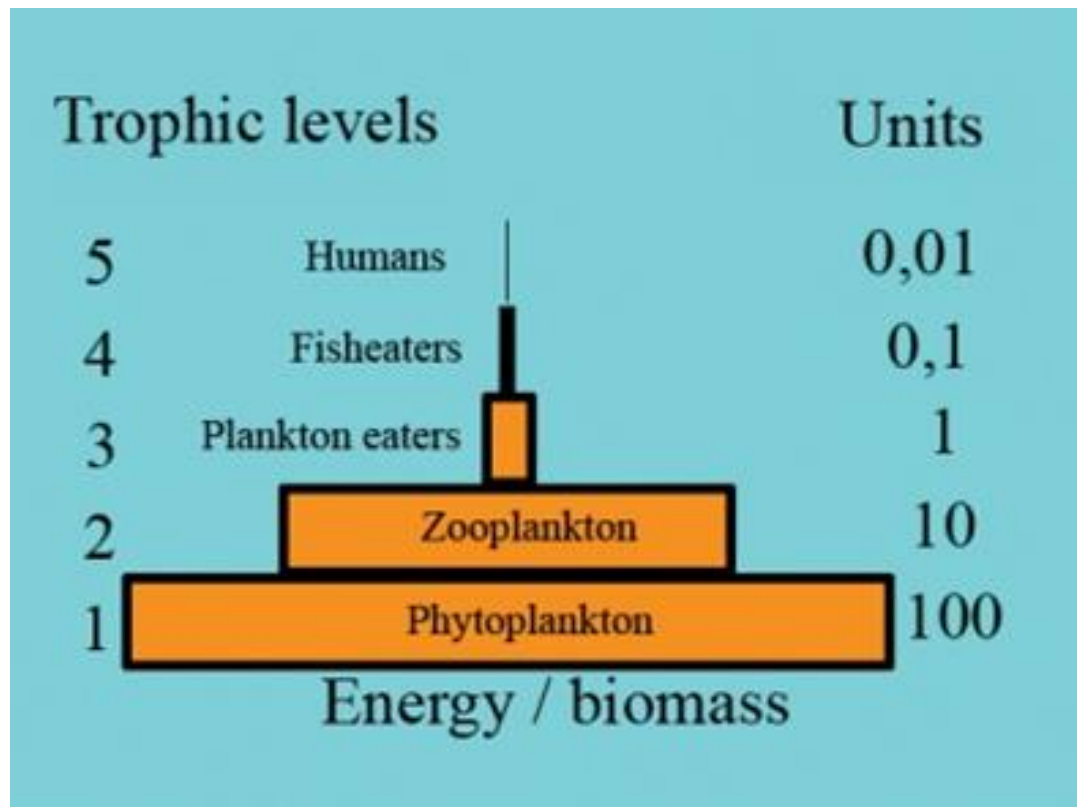
Calanus AS (continued):

- Market-driven up-scaling is in progress, including the contracting of additional vessels for harvesting and building a processing plant for manufacturing of products.
- The company has a research permit for harvesting 1.000 T/y. A management plan for the resource is being developed by the Norwegian Authorities, which will determine future quotas.
- Calanus AS is owned by the founders and regional investors. Currently a small organization (16 employees), outsourcing R&D and other parts of the operation.
- Good progress in sea activities, but we are awaiting a management plan with the legal framework for harvesting

Annual biomass production of 150-300 mill. tons in the Nordic Seas (>20 x the biomass of all fish species). The best coastal areas for harvesting are located outside of North-Norway.



Why harvest on lower trophic levels?



Principles for ecosystem harvesting

- Garcia et al. (2012)

«Reconsidering the Consequences of Selective Fisheries», Science, volume 335,

(«Balanced harvesting over a broad range of species, stocks and size groups would be more ecological correct than a focus on a few large single fish stocks»)



Calanus AS charters suitable vessels for harvesting



LJZH

ARNØYTIND

ARNØYTIND
TROMSØ

T-3-S



Towing at low speed requires low energy input and gives no by-catch of fish juveniles



Calanus AS is trying to develop technology and knowledge for selective fishing to avoid by-catch

An aerial photograph showing a large fishing net being pulled through the ocean. The net is a fine mesh, and the water around it is dark blue with white foam from the boat's wake. The net is being pulled from the top left towards the bottom right. The text is overlaid on a dark rectangular background at the bottom of the image.

Today's (1st generation) harvesting technology gives acceptable catch rates

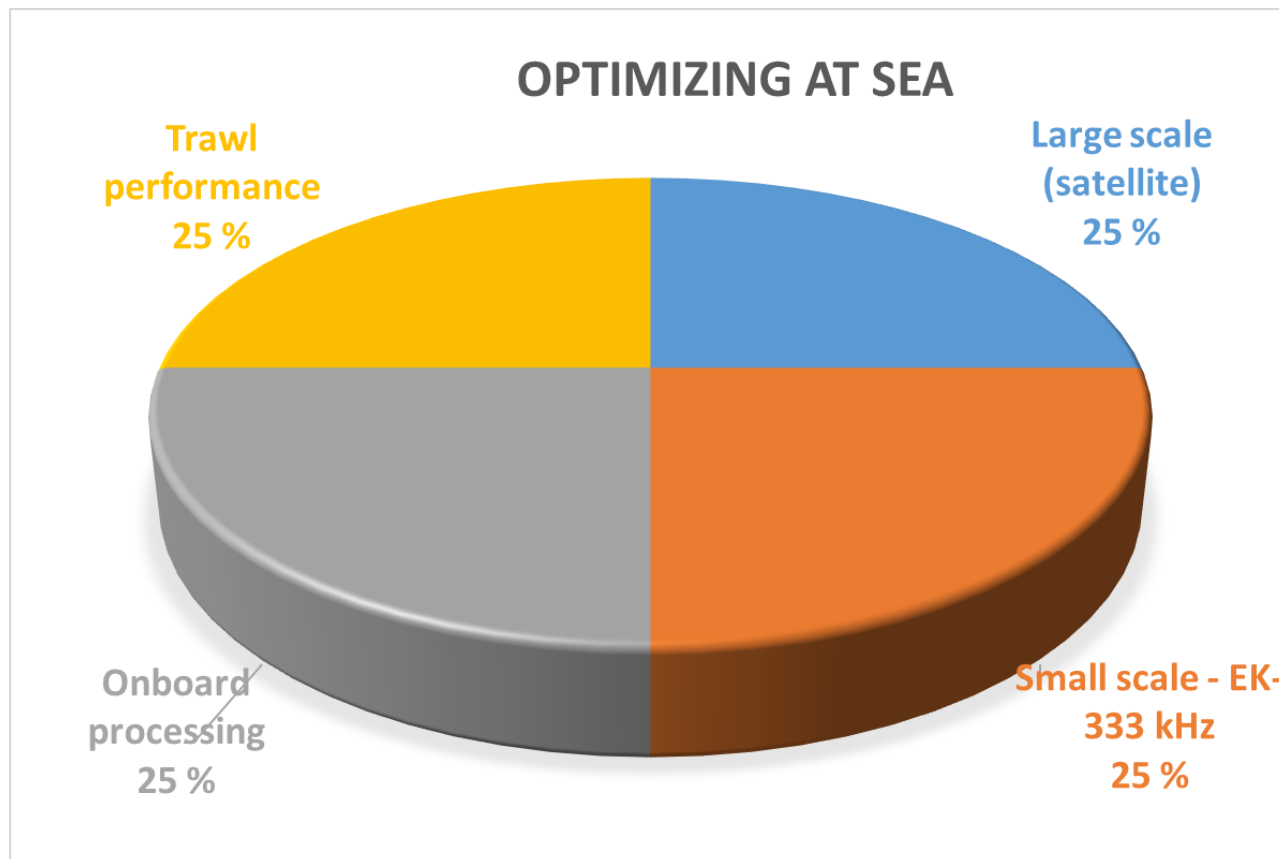


The catch is pumped from the cod-end for sifting/drainage



The raw-material is immediately frozen on-board for later processing in land facility

How to scale up from 1000 T per yr?



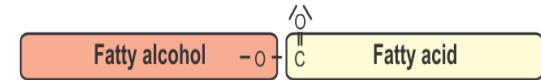


The main product is a marine oil with favourable biomedical properties

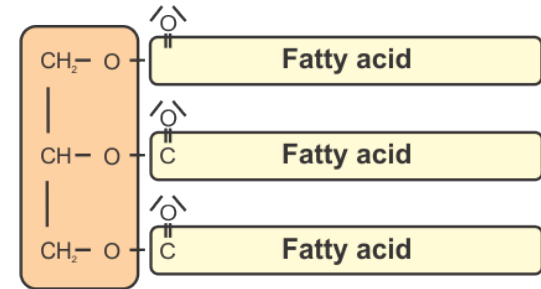
Marine oils



Wax ester



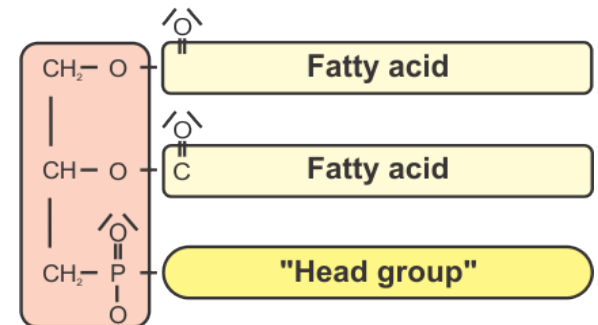
Triglycerides



Ethyl ester

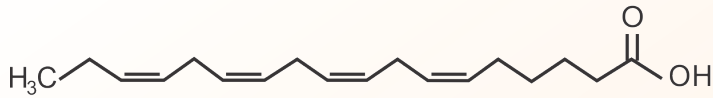


Phospholipid

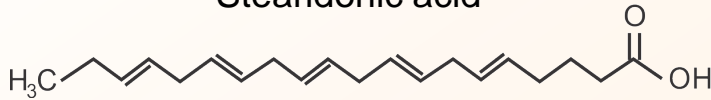


Composition of Calanus oil

n-3 PUFA



Stearidonic acid

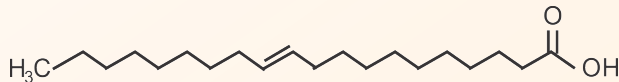


Eicosapentaenoic acid

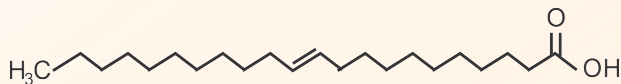


Docosahexaenoic acid

MUFA



Gondoic acid

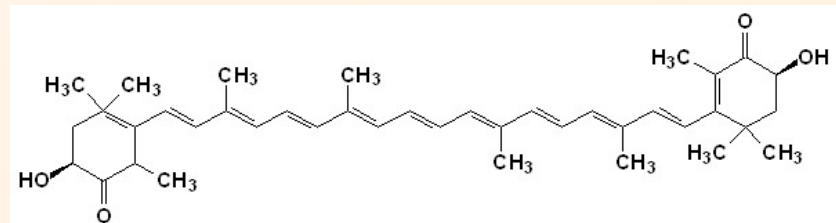


Cetoleic acid

Calanus finmarchicus



Astaxanthin



Calanus® Oil – in short:

- Omega-3 FA's as wax esters.
- Unique properties compared to other marine oils.
- Slow digestion and enzymatic hydrolysis in the mid-gut and hind-gut (esterase).
- Solid biomedical documentation in preclinical studies, clinic documentation is established and more are on the way.
- Prevent metabolic changes due to «western life styles» and counteract the development of obesity related disorders.
- Demonstrated to be safe, digested and bioavailable for human
- GRAS (USA) og Novel Food (EU)
- «3. generation omega-3 with a market potential up to 500 MUS\$» (Adam Ismael, GOED, 2014).

Calanus® Hydrolysate



Calanus® Hydrolysate L: Concentrate of peptides with functional properties

Ingredient in feed:

- Nature's own startfeed – fry of marine fish and prawn in aquaculture
- Cleaner fish (wrass and lumpsucker)
- Pet-food («palatant»)
- And a lot more is coming.....

Ingredient in food:

- Very good flavour
- Functional properties - human health
- Human sector is a high priority area for the company after being ISO-certified (2015)

Near future areas of priority:

- Adoption of a management policy by Norway
- MSC certification
- Harvesting technology – scale up for oceanic waters
- Further product and market development

Thank you for your attention