



Harvesting zooplankton– the Calanus case

Kurt Tande – CTO Calanus AS

NASF Conference – Bergen 7-9 March 2017

Contents



Calanus AS – A biomarine pioneer

Sustainability

The Norwegian Sea ecosystem

The management approach

Calanus® - Unique health & nutrition products

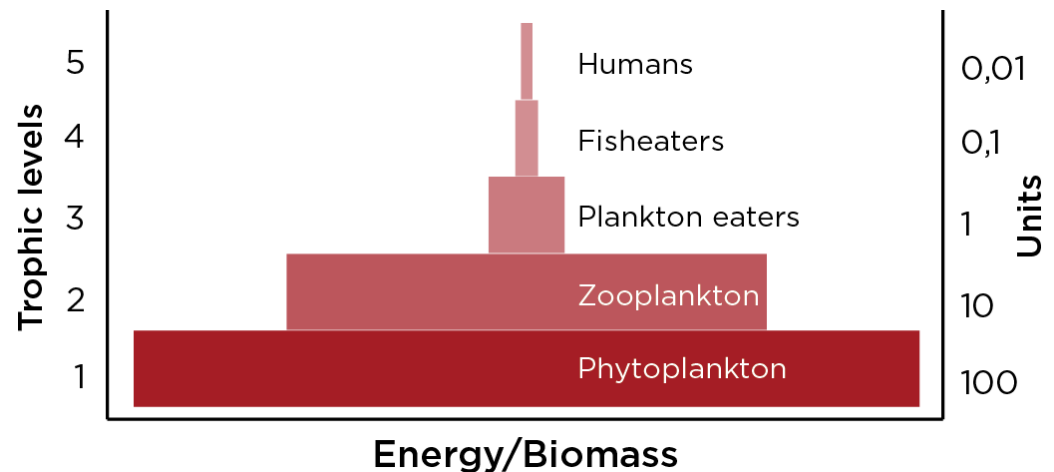
Future perspectives

Company introduction

- 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, developing technology and know-how enabling sustainable industrial harvesting and bioprocessing of *Calanus finmarchicus*
- Small organization with 16 employees currently, outsourcing R&D, chartering vessels for harvesting and leasing the manufacturing plant
- Developing unique health- and nutrition products based on *Calanus finmarchicus*; e.g.:
 - **Calanus® Oil:** 3rd generation omega-3 for human dietary use
 - **Calanus® Hydrolysate:** Functional peptide ingredient for starter feeds for aquaculture and premium petfood
 - **Calanus® Powder:** High quality source of protein and other nutrients suitable for aquaculture feed and petfood

Why harvest on lower trophic levels?

- Lower trophic level means «further down in the foodchain»
- Much larger biomasses are found on these lower trophic levels
- The yield from harvesting 1 unit of biomass also increases significantly as we move down to lower trophic levels
- Moreover, there is less persistent organic and inorganic «pollution» in biomass at lower trophic levels as a result of a shorter life-cycles and less accumulation than in animals higher up the food-web.



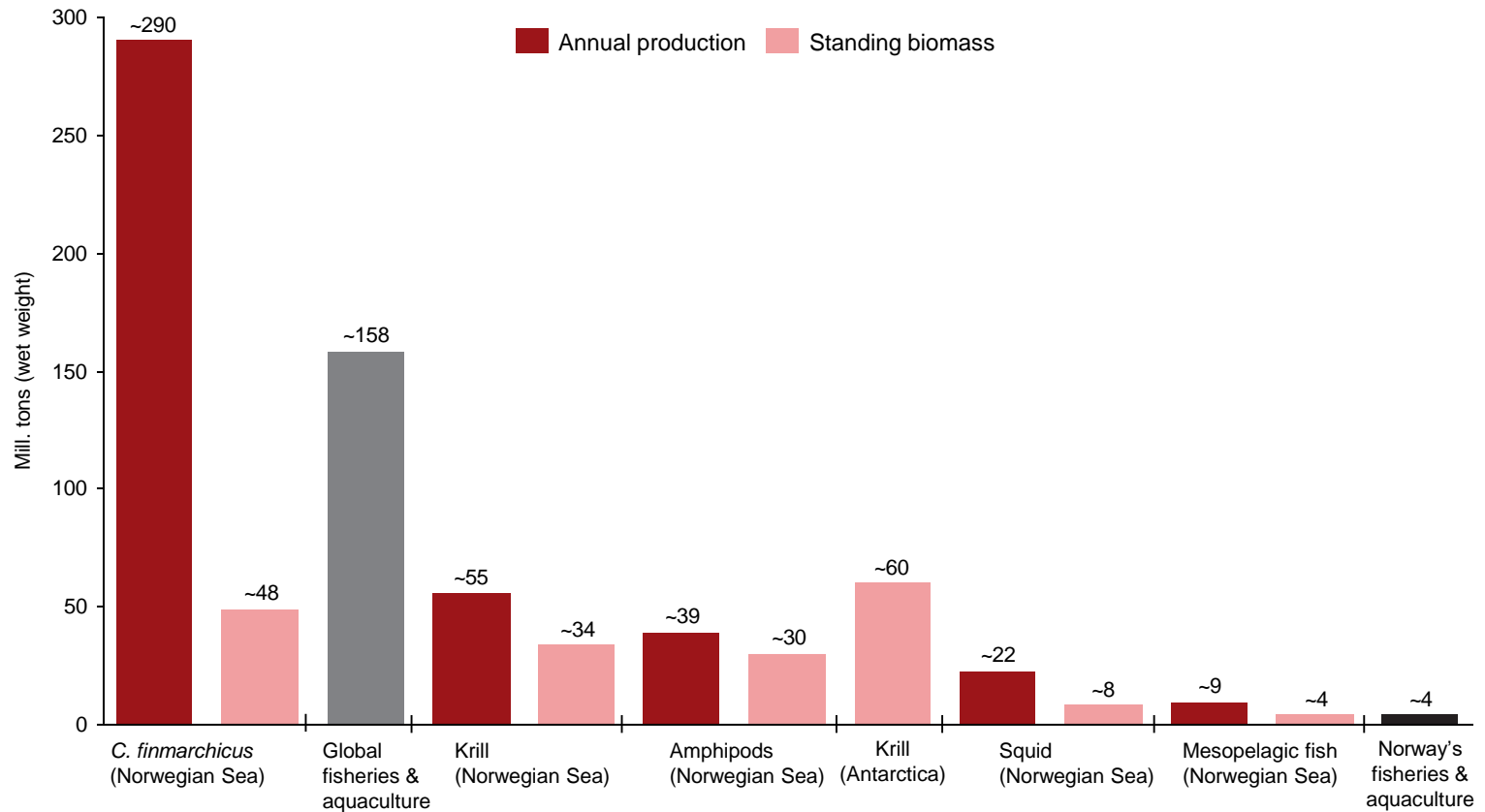
Principles for ecosystem harvesting

«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» (*In Reconsidering the Consequences of Selective Fisheries*, Garcia et al. 2012, Science, vol 335)

Company policy:

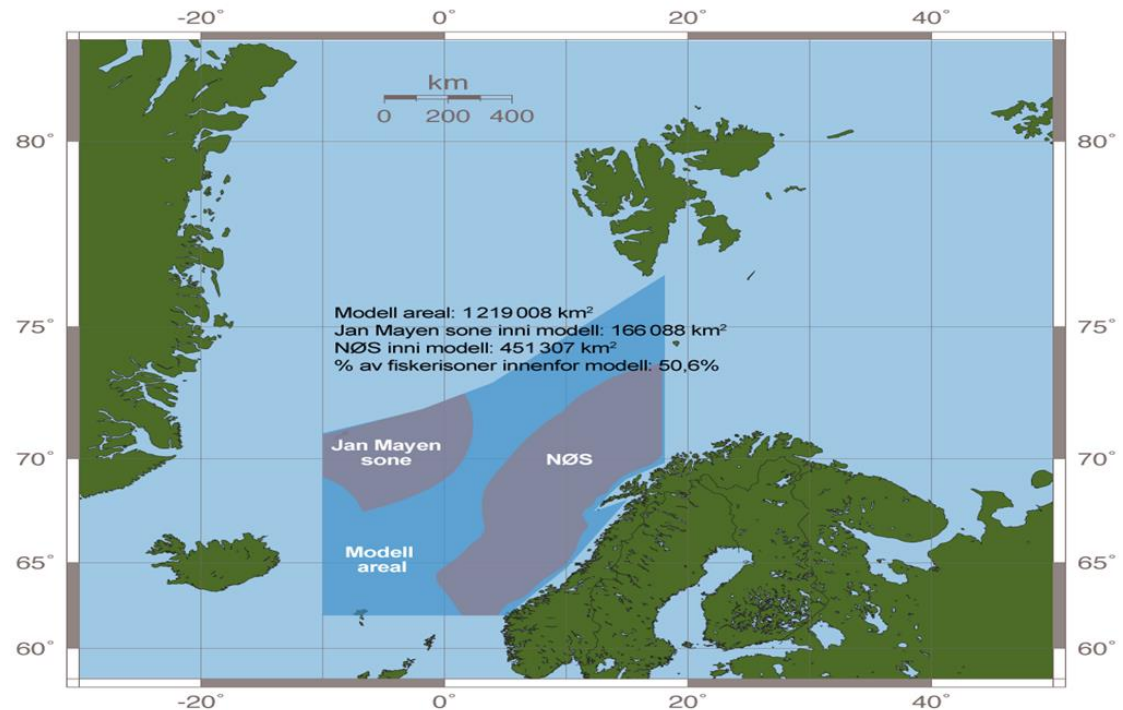
As an industrial company focusing on human health & nutrition, Calanus AS has a tremendous responsibility to develop sustainable practices including harvesting under a strong regulatory regime set by the Government.

Biomass and annual production of selected species



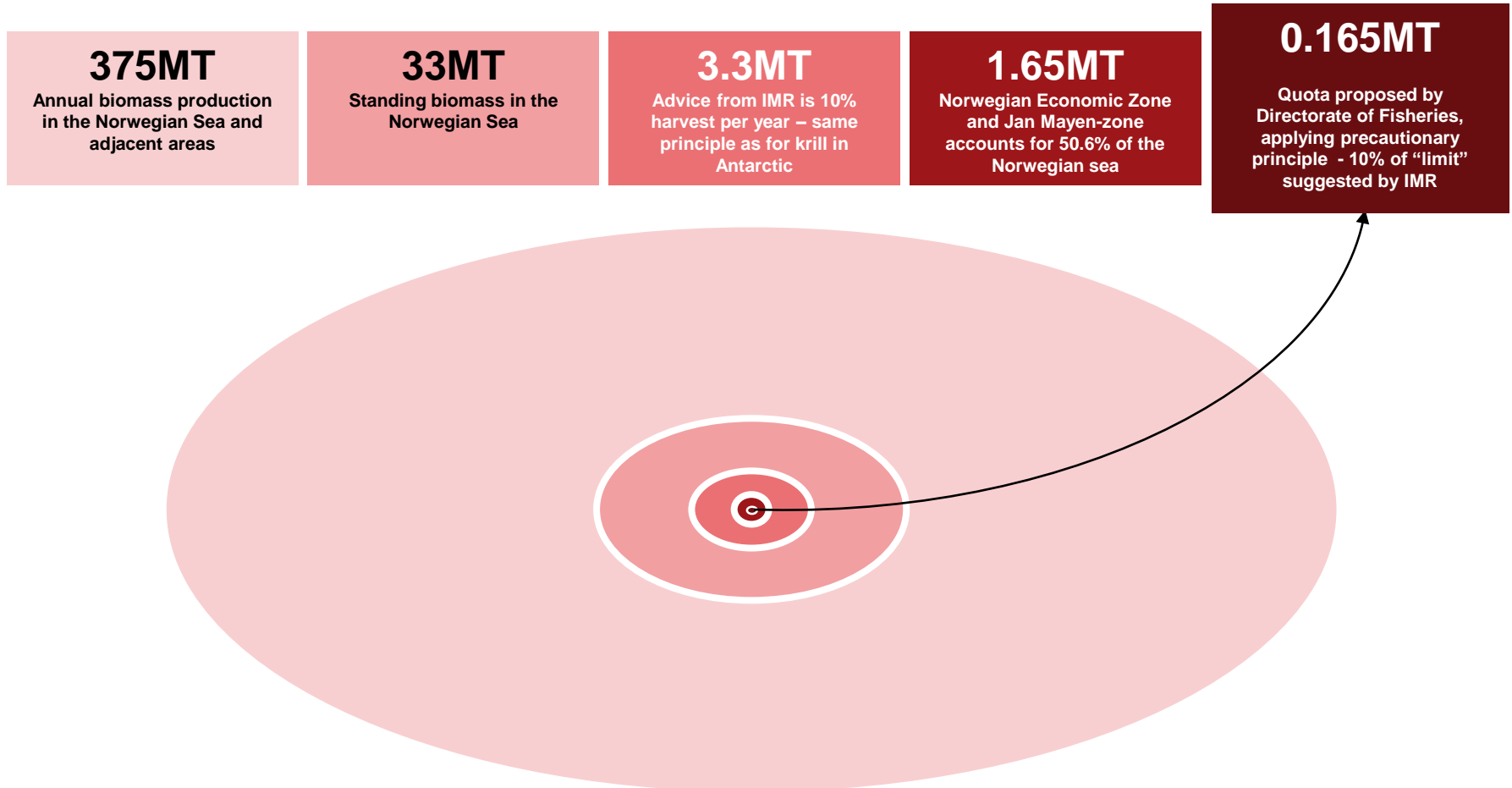
Management area and harvesting season

- Area of distribution:
 - North Atlantic
 - Barents Sea
 - Southern rim of the Polar Sea
- Harvesting season
 ~May-August, when *Calanus finmarchicus* lives in the surface (0-50m depth)



Proposed quota accounts for a very small fraction of biomass production

Guidelines from IMR (Havforskningsinstituttet) and Directorate of Fisheries (MT = Million Tons)



Value chain – Control from ocean to consumer

Vessels & quotas



- Currently chartering 2 vessels, others are interested and available as demand will grow
- Will not acquire own vessels, but use exiting capacity, as season is during May-August when alternative cost is at its lowest
- Currently a research permit of 1,000 tons per year. Annual quota of 165,000 tons has been proposed by the Authorities.

Raw material

Harvesting



- Has developed the Calanus®-trawl and supportive technologies for detection, harvesting and on-board processing
- Will license proprietary technology and extensive know-how to cooperating vessels
- Continue to develop technology for more efficient harvesting, particularly in oceanic waters where growth in quotas are projected

Processing

Onshore processing



- Currently Calanus AS is renting plant for process development and manufacturing of main products:
 - Calanus® Oil
 - Calanus® Hydrolysate
 - Calanus® Powder
- Planning to build own processing plant to improve processes (Tromsø or Sortland), increase capacity and benefit from economics of scale.

Sales and marketing

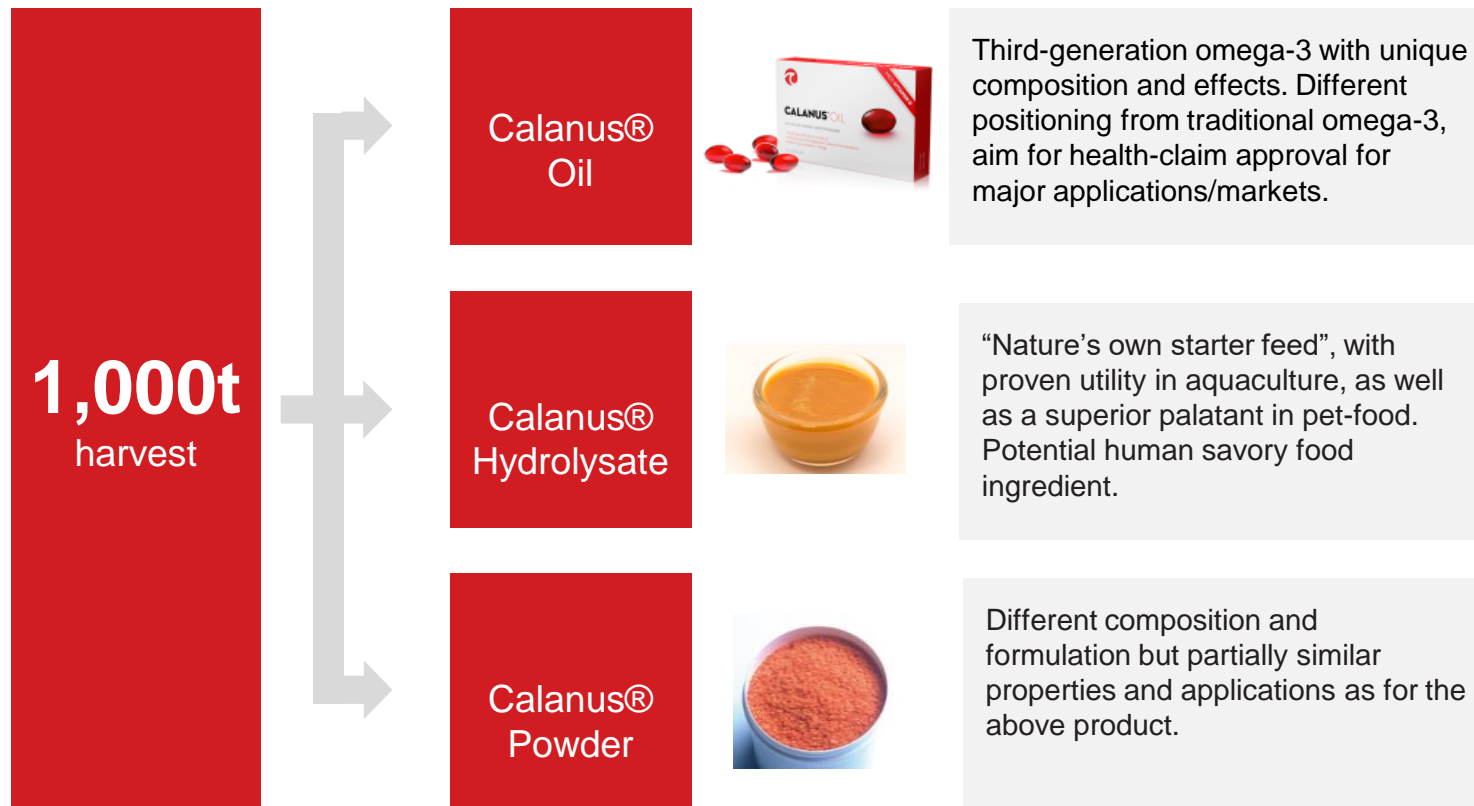


- Calanus AS has sales and marketing team to business consumers
- Key products introduced primarily in Norway. Ongoing business development and regulatory in preparation for sales internationally
- Calanus Helse AS sells directly to consumers in Norway

End clients

Yield per kilo harvested *Calanus finmarchicus*

Example for 1,000t harvest

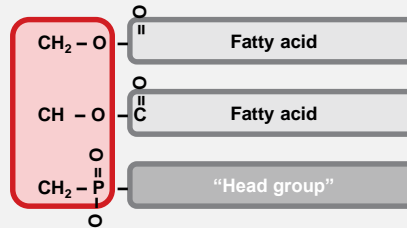


Wax ester content:

A feature of *Calanus finmarchicus* explaining uniqueness of Calanus® Oil



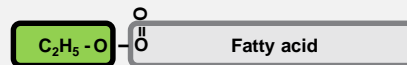
Phospholipid



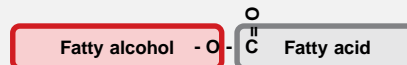
Triglycerides



Ethyl ester



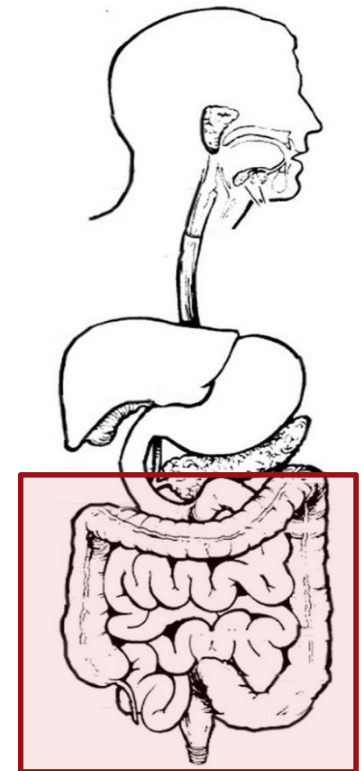
Wax ester



Fast

Digestive duration

Slow



Calanus® Hydrolysate

Features/Benefits

- Nature's own starter feed – for marine fish and shrimp in aquaculture, and salmon
- Highly potent marine flavor, proven excellent as an attractant and palatability enhancer
- Very good digestibility
- Heat stable and highly soluble
- Excellent amino acid profile
- Some product development work remains

Applications

- Ingredient in aquaculture starter feed for marine fish: Sea Bass, Sea Bream, Shrimp, Atlantic salmon
- Ingredient in aquaculture specialty feed: Medicated feeds, cleaner fish
- Ingredient in pet food: Palatability enhancer/digest in premium feed, palatant in treats, pet supplements, and pet pharma
- Product varieties for food to be developed: savor ingredients – sports nutrition – clinical nutrition

Calanus® Powder

Features/Benefits

- Partially de-oiled dried meal
- High protein content, chitin (from shell), residual lipid and minerals
- Heat stable
- Highly soluble
- Pleasant marine flavor
- Natural content of cadmium (however much less than in e.g. crab) may be a limit for uses in animals

Applications

- Ingredient in ornamental fish feed, including corals
- Ingredient pet food formulations.
- Ingredient in specialty aquaculture feeds

Development plan for the company 2017 - 2020

- Engage in development of management policy by Norwegian Authorities (biological and legal framework for harvesting)
- Financing of long term growth
 - Raising new equity during 2017
- Engineering and construction of a tailor-made and dedicated processing plant
 - Part 1: Project planning and purchase of land
 - Part 2: Construction, installing all equipment
 - Scheduled to be completed by mid-2019
- Continue to invest in R&D to develop:
 - Improved harvesting equipment and methods
 - Processing and products, regulatory approval
- Sign-up additional vessels and ramp up production, combined with increased business development & marketing efforts

	2017	2018	2019	2020
Regulatory framework	[Progress bar from 2017 to mid-2018]			
Financing of Calanus AS	[Progress bar in 2017]			
Engineering and construction of new factory	Part 1	Part 2	Factory finished	
R&D - Improved harvesting technology	Coastal → Oceanic			
R&D - Products, applications, RA	Product development / Clinical application / Health claims			
Charter additional vessels	2 vessels	+1 vessel	+1 vessel	+1 vessel
Increased marketing and sales efforts			[Progress bar from 2019 to 2020]	

Thanks to collaborating institutions and sponsors

- **UiT / the Arctic University of Norway**
- **UNN**
- **NOFIMA**
- **NORUT**

- **INNOVATION NORWAY**
- **MABIT**
- **RESEARCH COUNCIL OF NORWAY**