

The Industry's Mesopelagic Initiative

Strategy for sustainable harvesting and processing of mesopelagic fish





The Industry's Mesopelagic Initiative

To develop the commercial potential in the mesopelagic fisheries is not a one-company task, but a national or Nordic/international responsibility

The Industry's Mesopelagic Initiative

Outline

- Why mesopelagic fish (salmon feed example)?
- Liegrupper
- Surveys with "Birkeland" 2016 – 2018
- Catch
- Chemical analyses
- Processing
- Gear
- Further strategy

Why mesopelagic fish? Salmon feed & soy protein

Aquaculture, salmon and trout

1999

Economic value:
12.1 billion

180%

2010

Economic value:
34 billion

250%

2030

Economic value:
119 billion

100%

2050

Economic value:
238 billion

Volume:
0.5 mill. tonnes

100%

Volume:
1.0 mill. tonnes

200%

Volume:
3.0 mill. tonnes

70%

Volume:
5.0 mill. tonnes

Why mesopelagic fish? Salmon feed & soy protein

5 mill. tonnes Atlantic Salmon (2050), same recipe, correspond to 912 000 ha. soybean farmland covering the **protein content**

Or:
93 % agricult. land in Norway
1,3 mill. soccer fields*

Production of 5 mill tonnes:
= 6 mill. t. mesopelagic fish
= 0,6 ‰ of biomass 10 bill.t
+ essential marine oils



Photo: ALBERTO CESAR-GREENPEACE / AP



*) Grimsmo, L., Almås K. A. og Hognes, E. (2017). "Industriell utvikling av et mesopelagisk fiske – miljøeffekter" SINTEF rapport OC2017 A-196

Pioneering mesopelagic fishing in the Oman Gulf by Liegruppen 1992

Challenges for business development:

- Resource biology knowledge
- Fishery technology
- Product refinements
- Market developments
- Geopolitics challenges

The pioneers



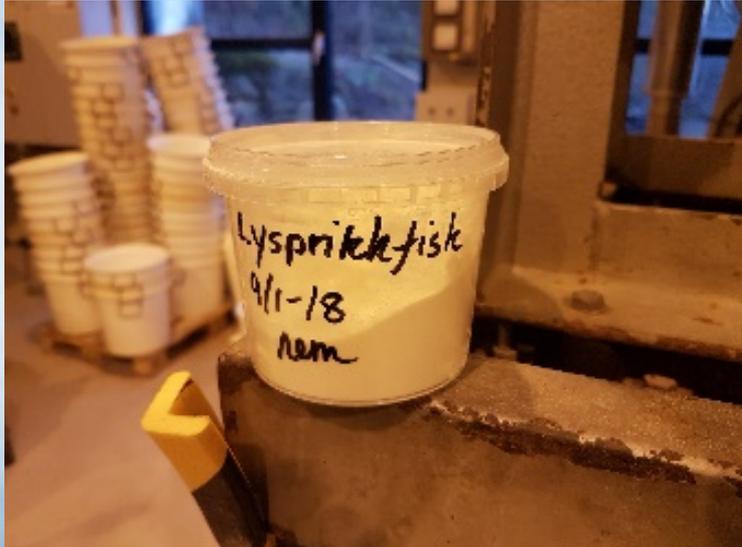
First commercial catch of Mesopelagic fish in Norway sold by "Liafjord" 17 tonnes pearlside, July 2018



Pearlside protein refined by Biomega Group in waffles!

(Courtesy Kjartan Sandnes, Biomega)

BIOMEGA

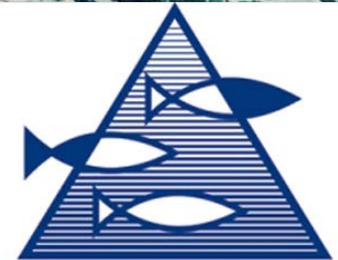


LIE GRUPPEN

Surveys with "Birkeland" 2016 - 2018



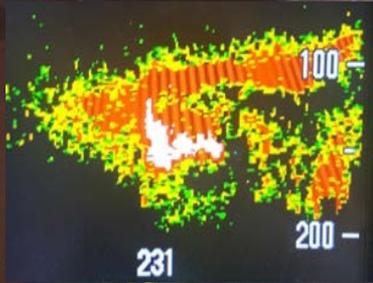
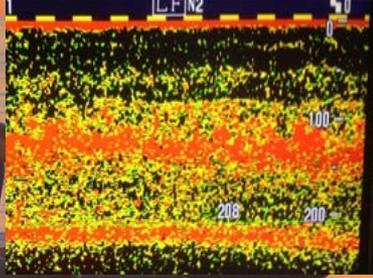
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HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH



Surveys with "Birkeland" 2016 - 2018



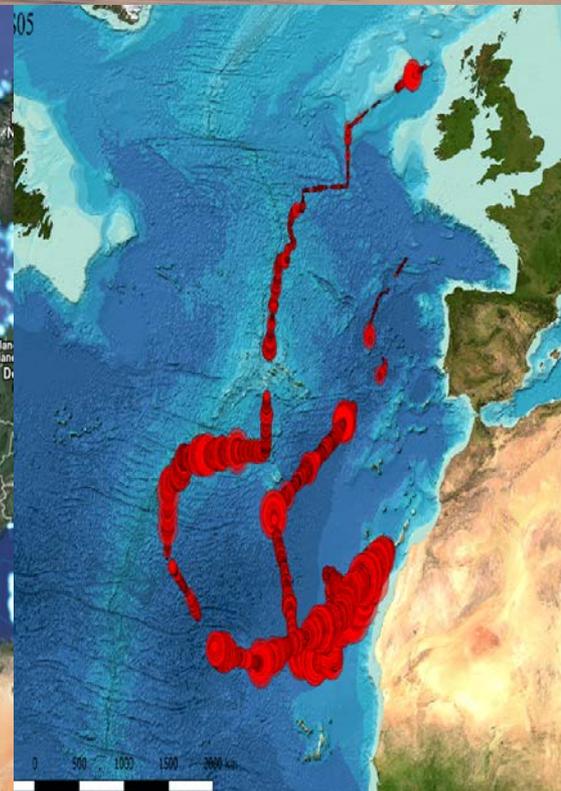
Surveys with "Birkeland" 2016 - 2018

June - July 2016

April – May 2017

July 2017

April – June 2018



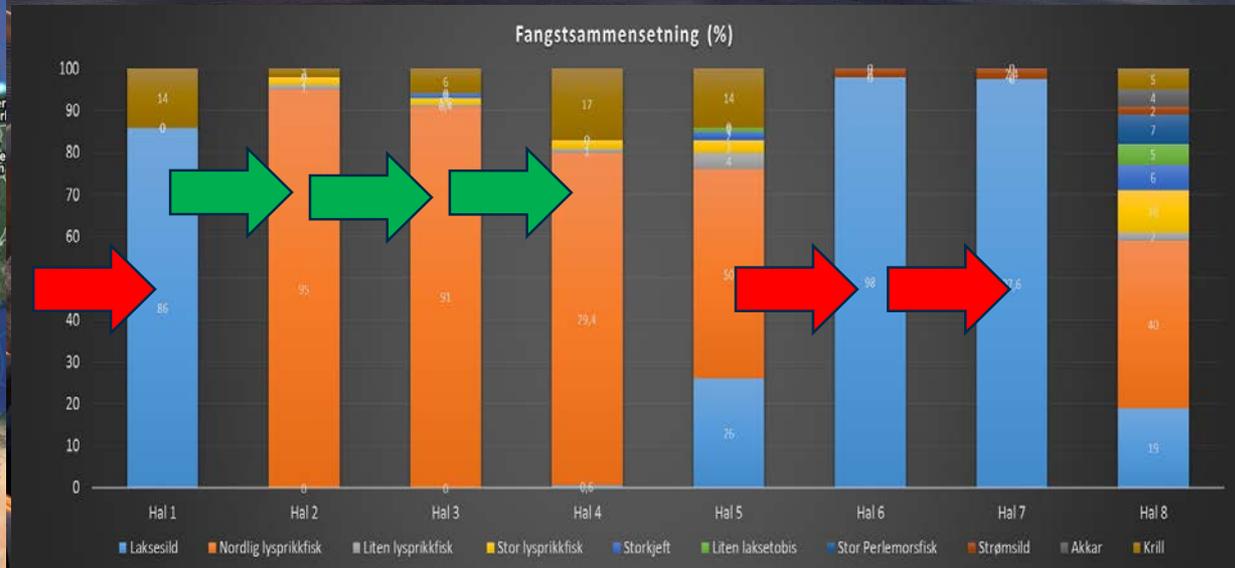
Catch

Catch composition (June-July 2016)



→ *Maurolicus muelleri*

→ *Benthoosema glaciale*



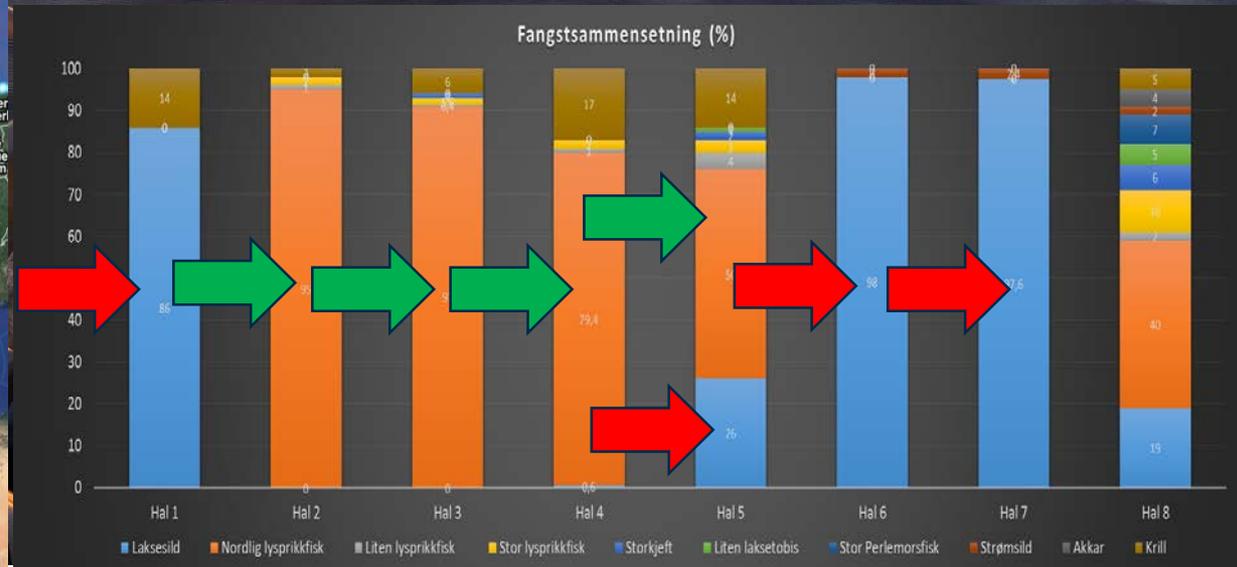
Catch

Catch composition (June-July 2016)



➔ *Maurolicus muelleri*

➔ *Benthoosema glaciale*

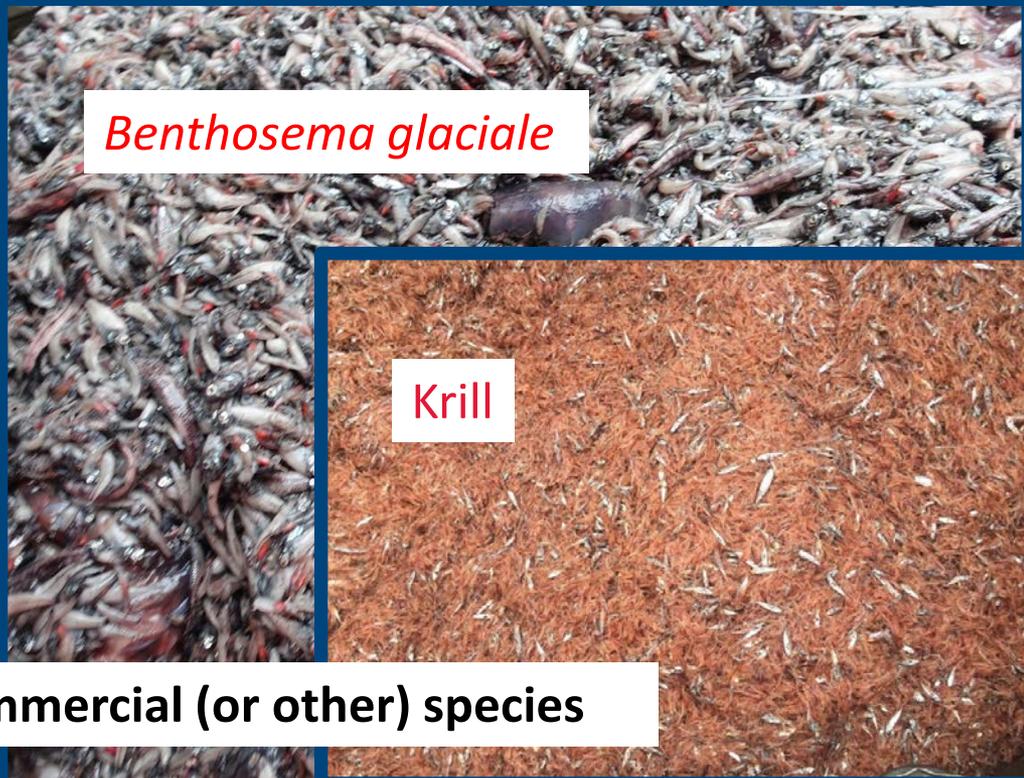


Catch

30 mesopelagic species, but 98%: pearlside, *Benthoosema* & krill



Maurolicus muelleri



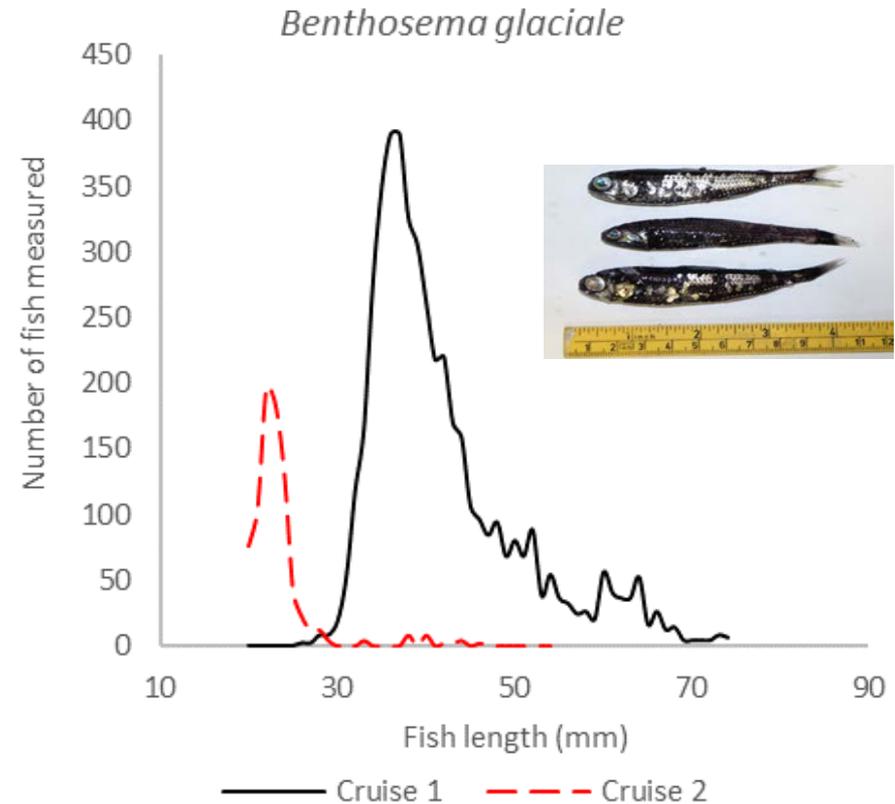
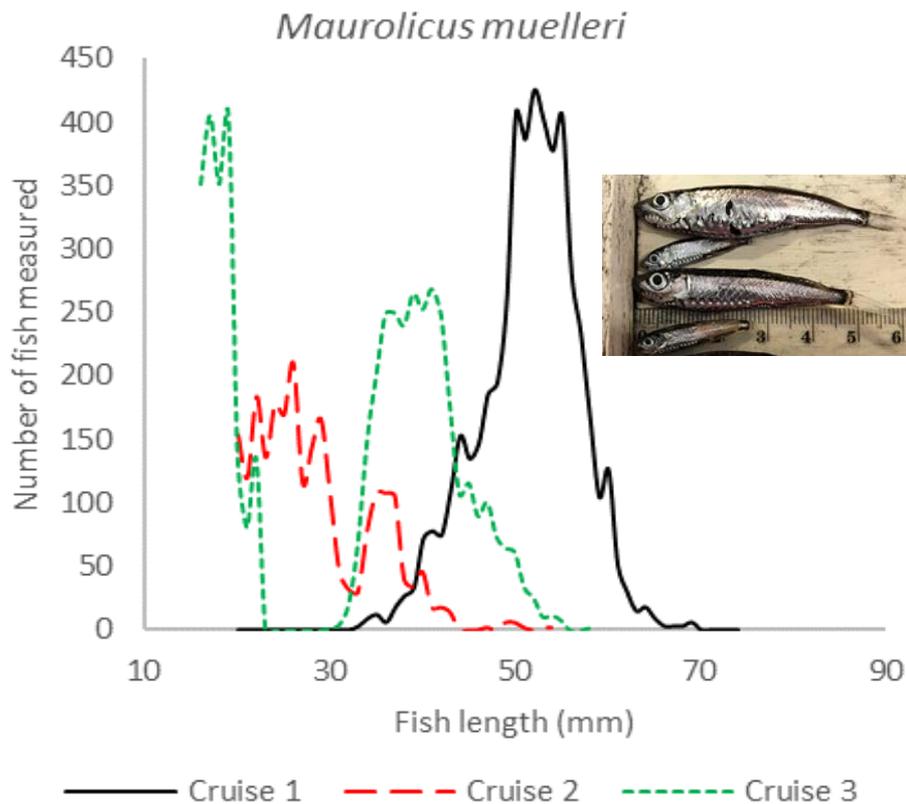
Benthoosema glaciale



Krill

No significant by-catch of commercial (or other) species

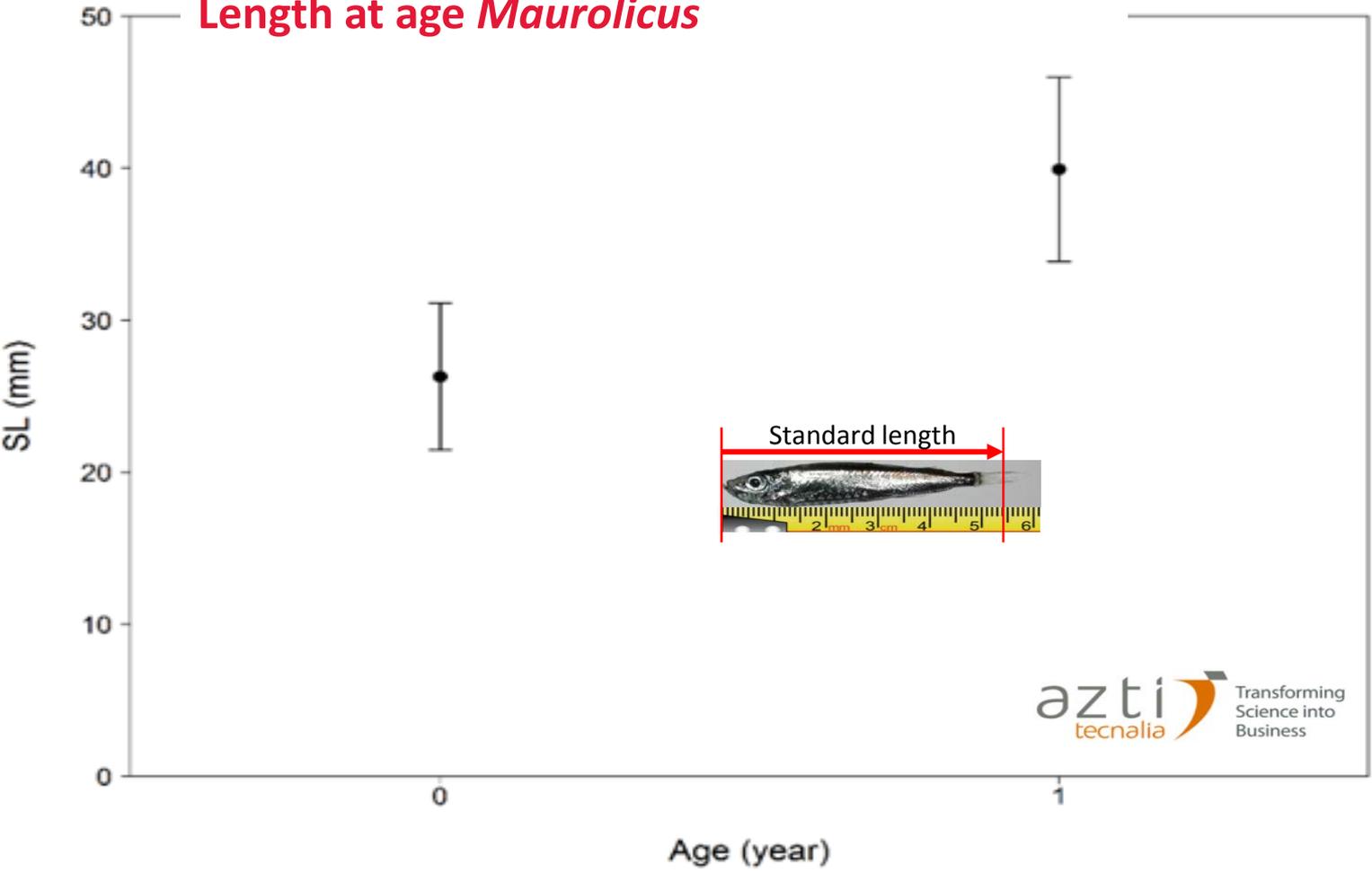
Catch



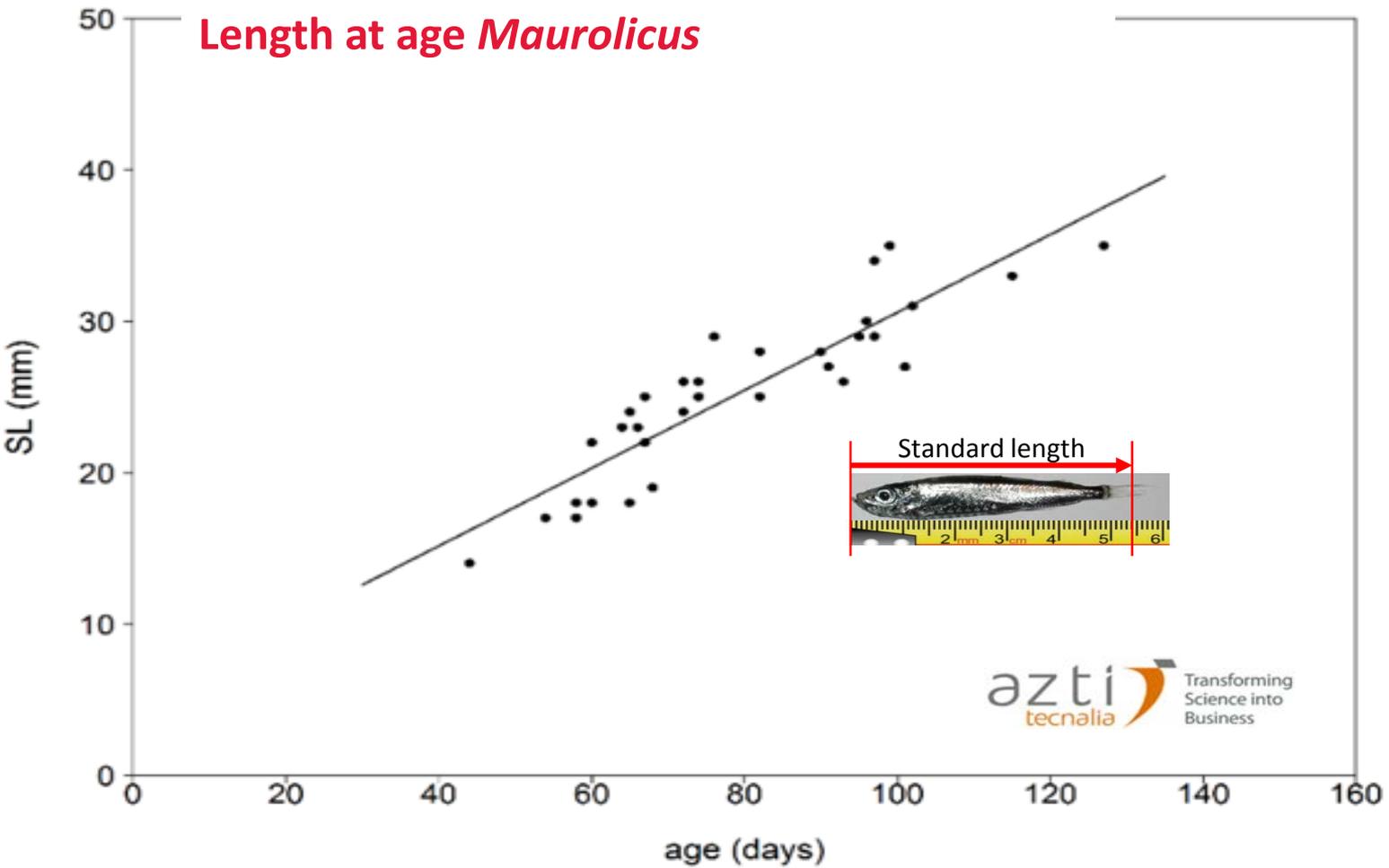
Cruise 1 2016, cruise 2 & 3 2017

Catch

Length at age *Maurolicus*



Catch



Catch

Individual growth and early maturation of *Maurolicus muelleri* can indicate very high biological production in the investigated areas

Chemical analyses

Lipids (extracted): 4,3% -15,8% (wet)
17,9% - 49,7% (dry)

Omega 3 (average): 24,5% of tot. lipids

EPA+DHA (average): 22% of tot. Lipids

Protein: 13,5%-16,5% (wet weight)

Water: 68,2%-76%

Chemical characterization indicates high commercial values

Chemical analyses

Benthosema glaciale

70-80% waxesters



Maurolicus muelleri

70-80% triglycerides



Processing



Processing



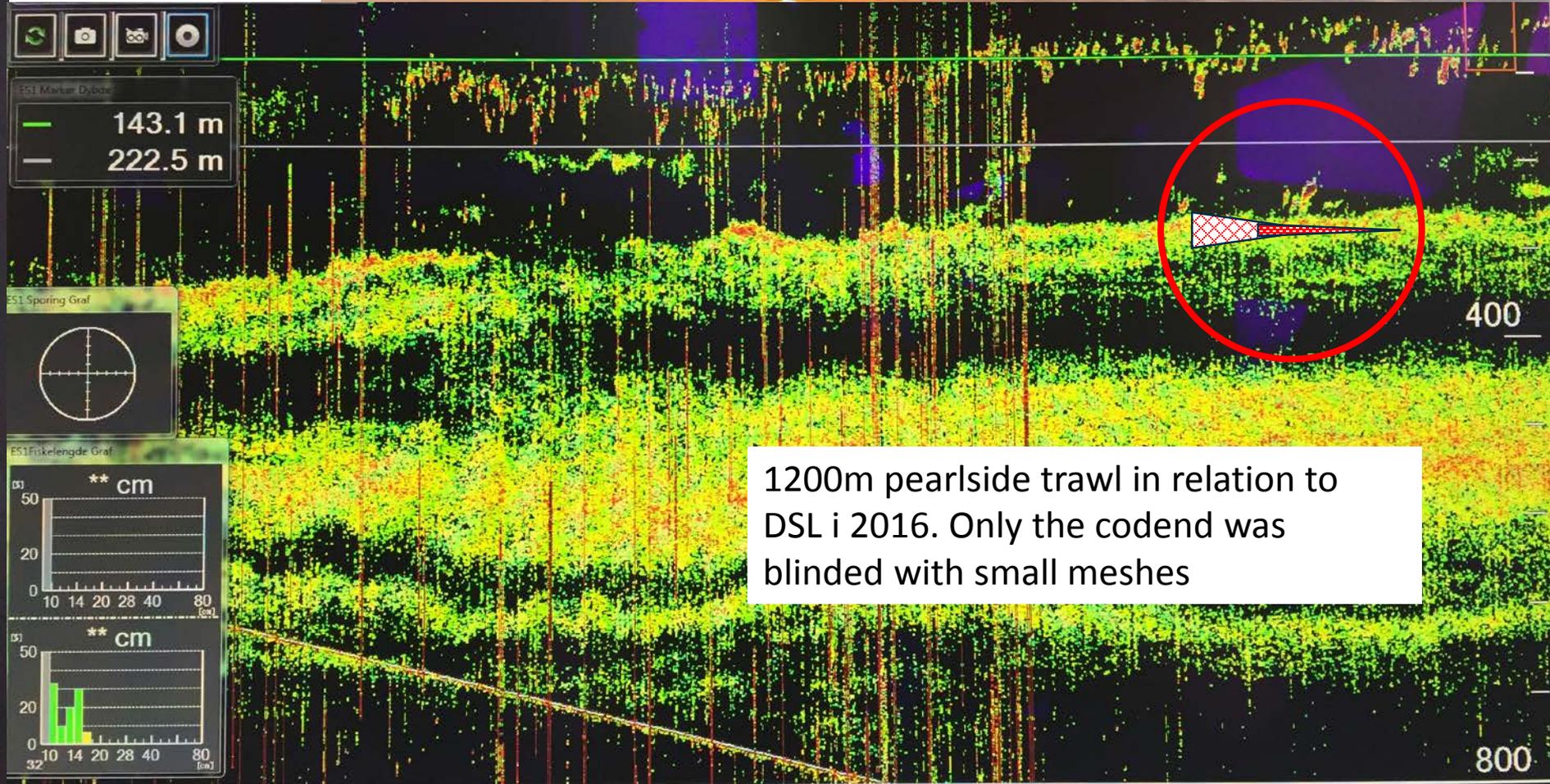
Processing

Oil yields lab scale from wet weight

	Raw material	Termic	Endogenous	Enzyme a	Enzyme b	Enzyme c
Fat haul 1	15,8 %	12,4 %	12,8 %	14,1 %		
Fat haul 2	11,1 %	10,1 %	12,5 %	13,7 %	13,7 %	14,4 %
Fat haul 3	13,7 %	12,7 %	16,8 %	15,5 %	15,3 %	14,6 %
Fat haul 4	12,0 %	11,3 %	15,3 %	14,4 %	15,8 %	16,5 %
Fat haul 5	12,2 %	9,5 %	11,3 %	12,5 %	13,1 %	14,2 %
Fat haul 6	6,2 %	5,3 %				6,2 %
Fat haul 7	4,3 %	2,8 %	2,4 %	2,4 %	2,4 %	2,5 %
Fat haul 8	7,0 %	5,9 %	10,3 %	9,2 %	6,8 %	9,8 %
Fat haul 9	5,4 %					
Fat haul 10	11,1 %					
Average	9,9 %	8,8 %	11,6 %	11,7 %	11,2 %	11,2 %

Gear

38kHz ecogram



Gear

Trawl development: Small scale testing

TRAWL 1:

1200m mesopelagic fish trawl, Danmark 21.sep.2016

Company	EGERSUND TRAWL		Model No:	1166
Trawl	1200 m Mezopelagisk		Scale:	1 : 50
Trawl doors	25 m ² ET Speed			
Sweepline	m			
Bridles	120 m			
Set Back	8 m			
Clump	1500 kg			
Weights				
Other	1000 kg	sonde		
	300 kg	opdrift		



Test		1	2	3	4	5	6	7	8	9	10
Towing speed	knots	2,5	2,5	2,5	2,5	2,5	2,5	2,0	2,5	2,5	2,0
Distance between doors	m	150,0	150,0	150,0	155,0	155,0	100,0		100,0	95,0	92,5
Spread	Headline										
	Footrope										
	Side lines			84,9	74,6	76,6	60,4	57,6	57,7	55,8	54,1
Height	Wingend										
	Centre			54,5	41,7	49,1	54,6	61,3	59,9	50,6	53,6
Tension per side	tons	56,6	49,5	43,2	36,5	35,3	32,9	24,0	32,2	28,3	21,0

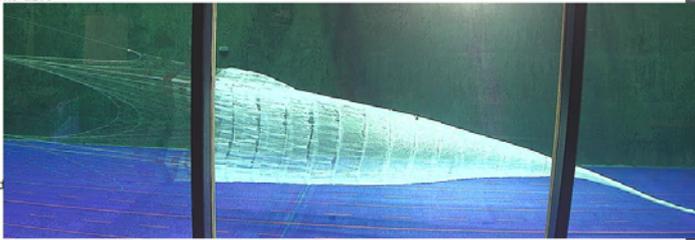
Test	Notes	Test	Notes
1	Original rig	6	Mindre afstand mellem døre
2	Indgang til Bleen 100x 68 m = 5400 m ²	7	Indgang Ble 2590 m ²
3	Hældelen af bleen fjernet de 3 første sektioner	8	Som test 6, indgang ble 2850 m ²
4	INDGANG Ble: 85 m x 55 m = 3600 m ²	9	Rigget med 90 m stjerner
5	totalt 4.5 sektioner fjernet, indgang ble, 74.5 x 42 m = 2450 m ²	10	Indgang ble 2710 m ²
	Indgangen skåret ned med 4 masker per plade		1.5 sektion ble fjernet , 2200 m ²
	Indgang ble : 2953 m ²		Som test 9, Areal indgang ble: 2276 m ²

21. September 2016 SINTEF Fisheries and Aquaculture, The North Sea Centre, Hirtshals

TRAWL 2:

800 m pearlside trawl, Danmark 14.okt. 2016

Company	EGERSUND TRAWL		Model No:	1168
Trawl	800 m Laksesild trawl		Scale:	1 : 40
Trawl doors	Pelagiske døre			
Sweepline	m			
Bridles	90 m			
Set Back	10 m			
Clump	2000 kg			
Weights				
Other	500 kg i sonde			



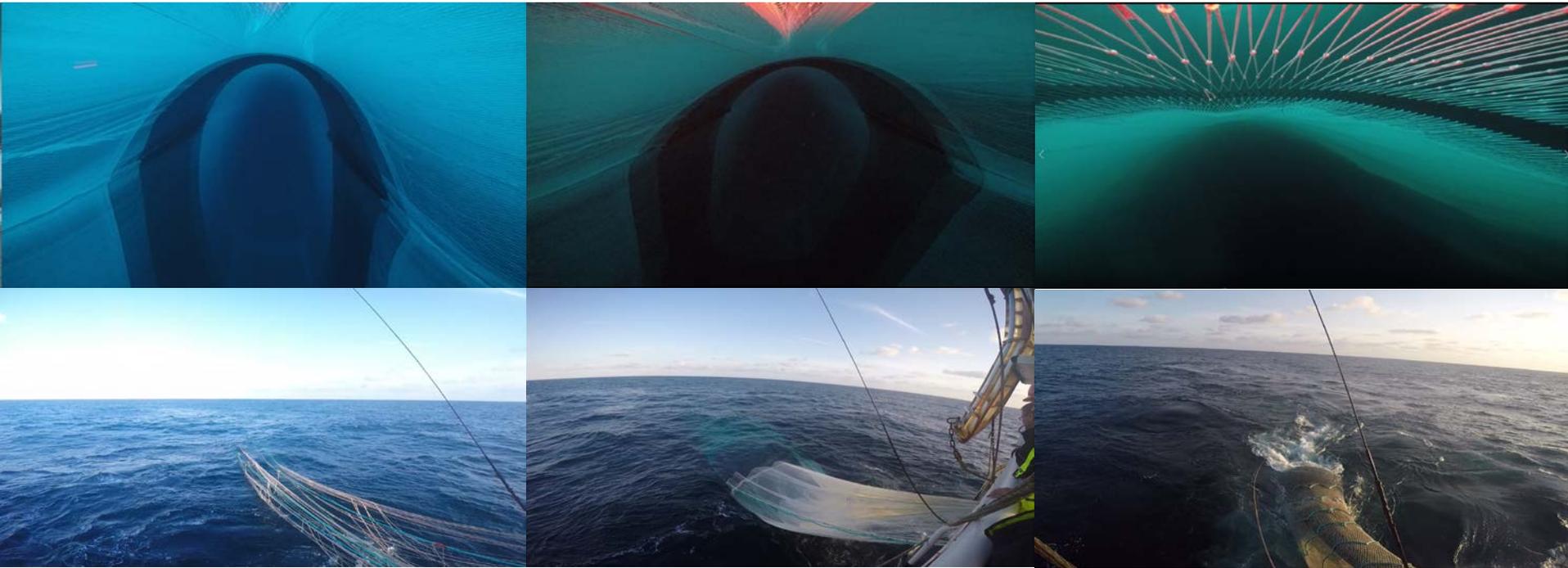
Test		1	2	3	4	5	6	7			
Towing speed	knots	2,5	2,0	2,5	2,0	2,5	2,0	2,0			
Distance between doors	m							56,0	41,1		
Spread	Headline										
	Footrope										
	Side lines										
Height	Wingend			71,5	47,2	41,9	42,7	45,4	47,0	42,5	
	Centre			37,7	45,0	30,0	34,1	44,9	45,0	45,9	
Tension per side	tons			41,2	22,3	27,8	20,4	31,6	22,0		

Test	Notes	Test	Notes
1	1000 kg klumper areal 2100 m ²		
2	2000 kg klumper areal 1920 m ²		
3	to bleer fjernet indgang næsten rektangulært ca 1200 m ² ,		
4	Mindre slæbehastighed areal ca. 1250 m ²		
5	Trawis forstykke reduceret, areal indgang 1600 m ²		
6	Mindre slæbehastighed areal ca. 1680 m ²		
7	Afstand ved galger 30 m, Areal indgang ble 1530 m ²		

14.10.2016 SINTEF Fisheries and Aquaculture, The North Sea Centre, Hirtshals

Gear

Trawl development: Geometry measurements



Undesirable substances

- Very low values of unwanted substances such as dioxins, PCBs, PAH, chlorinated pesticides, and heavy metals (Pb., Cd., Hg. og As.). *)
- Far below recommended limits in the the directive on undesirable substances in animal feed*

*) DIRECTIVE 2002/32/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 May 2002 on undesirable substances in animal feed.

Further strategy

- The Norwegian government recommend a strategy for establishing more knowledge on mesopelagic resources and their potential as future food and feed resources
- The fleet owners in this Industrial Mesopelagic initiative have considerable excess capacity in their fleet of pelagic trawlers
- There are challenges to fit in with the available sources for funding of expensive but necessary surveys

Further strategy

- The mesopelagic potential can only be investigated and realized in a joint and committed long time effort between:
 - Governmental bodies including the Norwegian Institute of Marine Research (IMR)
 - Leading private companies and
 - Leading R&D institutions

