Bergen, 23 November 2017
Subsea market outlook – Arctic and northern regions

The Barents Sea: research, innovation and subsea market

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The Barents Sea: research, innovation and subsea market

• Increase understanding of natural variations on marine production and commercial harvest

• By use of
  Advanced modelling and modern technology for increased data collection

• Russia
The big Question: Match - mismatch

Norwegian atlantic cod – 3 years

Haddock 3 years
Seal invasions in Finnmark 1986-1989

Haug et al 1990
Fig. 3. Euphausiid distributions in (A,B) very cold (1978) and (C,D) very warm (2007) years. (A,C) *Thysanoessa inermis* and (B,D) total euphausiid abundance. Densities (ind. 1000 m$^{-3}$) indicated by color scale.

Krill in cold years (A og B – 1978) and in warm years (C og D – 2007). *Thysanoessa inermis*. 

Orlova et al. 2010 Aquat Biol
Where is the polar cod during winter?

Ecological impacts of hydrocarbon seepage

Film av fisk ved en undervannsinstallasjon
Harvesting calanus and krill

Figure 1: Harvesting surface patches of Calanus finmarchicus. Picture by Calanus AS.
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Relation between death of individual animals and eco-system impacts

Of 1 mill cod eggs spawned, only 6 survive to mature age (ca 5 years)
Laboratory studies: Oil and impact on fish larvae

Fig 5. Abnormalities resulting from embryonic oil exposure. One day post hatch, 7 days of exposure. (A) Control. (B) and (C) Low dose group. Abnormalities are indicated: Pericardial edema (P), yolk sac edema (Y), spinal curvature (S), craniofacial deformities (CD), jaw deformities (JD).
What is the potential loss of cod larvae from the Lofoten – Vesterålen nursery grounds?

What is the potential impact on the Barents Sea cod stock?
Simulation of oil on Atlantic Norwegian cod

- **Olje og transport**
- **Oceanography, primary & secondary production**
  - Fish eggs & larvae
- **Population model (hunting included)**
- **SINTEF**
- **3-D MODELLER:**
  - Exposure
  - Adults
  - Harvested Resources
  - Simulations
  - Juveniles

Tettetnavhengig dødelighet
GLIDERS - Unmanned ocean exploration

Joint glider operation. The platforms collect field data and send via on shore satellite. From left to right: Wave Glider, Sailbuoy and Seaglider™. (3D visualization by courtesy of Kongsberg Maritime.)

Supported by Norwegian Research Council DEMO2000, and ConocoPhillips

Headed by Akvaplan-niva
Main partners: UiT, Nord University, NIVA, Met.no, Kongsberg Maritime, Maritime Robotics, Christian Michelsen Research and Offshore Sensing
Data collected

**Physical**
- Weather data (wind, temperature, pressure)
- Oceanographic data (temperature, salinity, current, alkalinity, oxygen, currents, waves)

**Biological**
- Fish larvae and zooplankton (abundance and geographical distribution)
- Copepod migration (timing, abundance and distribution)
- Primary production and marine acidification
- Mammals (identification and location)

**In situ sampling**
- For ground truthing
- Sensor calibration
From Sandnessjøen to Bodø
1st August to 6th September.

1200 km sailing distance
Russia and Barents Sea east

Reducing the risk
Environmental Information – Russian & Norwegian border areas in the Barents Sea

Joining a major Russian federal research program 2017-2019