Valuable and vulnerable areas: the case of the Barents Sea

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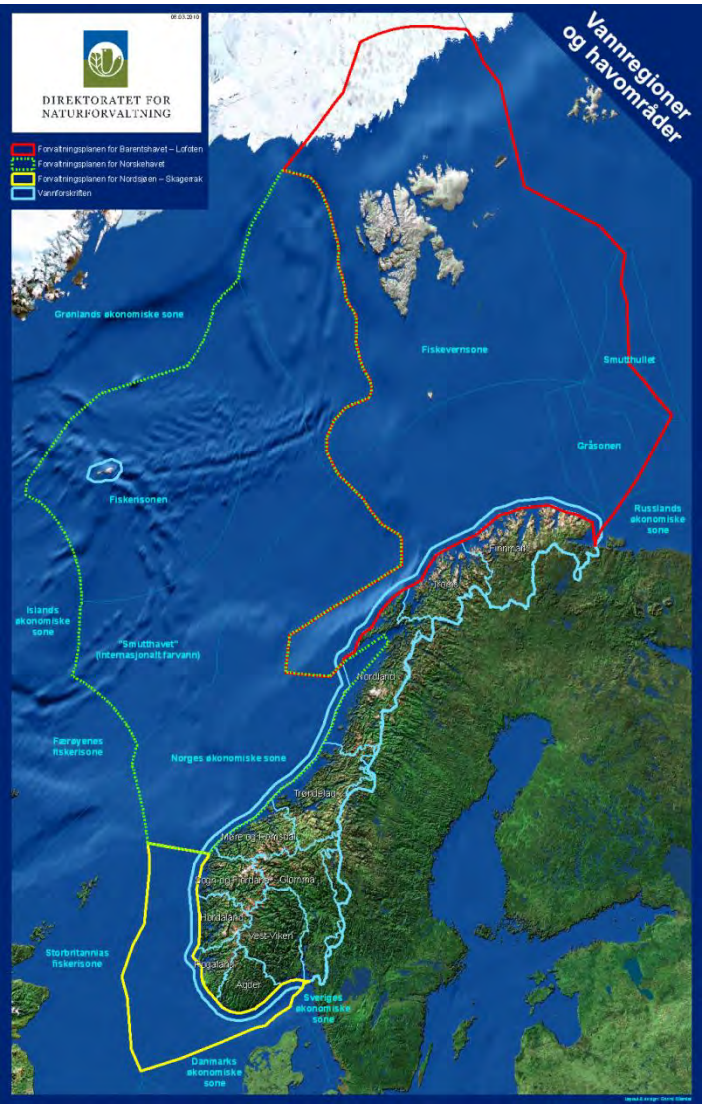
Copenhagen, 2 February 2017

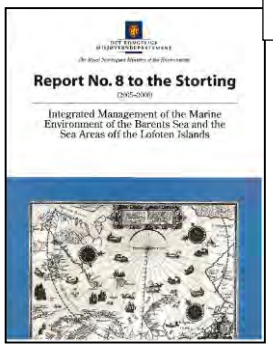
Outline

- The management plan for the Barents Sea – Lofoten area
- Consequences for the activity in the area
- The ocean environment
- Valuable and vulnerable areas - The identification process
- Challenges
- Identified areas

The management plan for the Barents Sea

Management plans for Norwegian Sea Areas





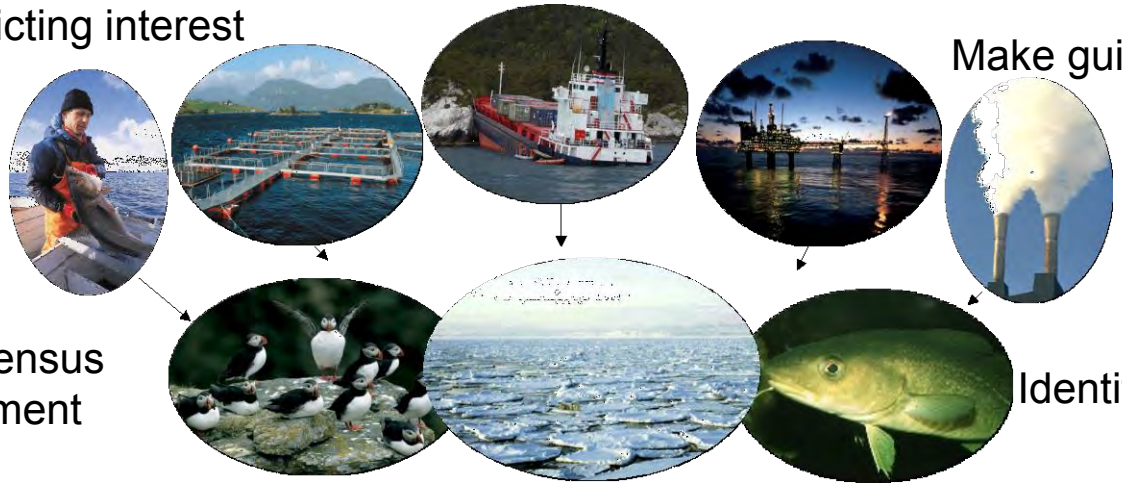
- Integrated Management plan for the Barents Sea and Lofoten (2006):
  Follow up – updated early 2011 and then April 2015. Revision in 2020
- Integrated Management plan for the Norwegian Sea(2009):
  Follow up – updating at the latest in 2017
- Integrated Management plan for the North Sea – Skagerrak (2013)

Need for more comprehensive, ecosystem-based management

The purpose of the **Integrated Management Plans** is to provide a framework for the **sustainable use** of natural resources and goods derived from an area and at the same time maintain the structure, functioning and productivity of the ecosystems of the area.

Evaluate conflicting interest

Make guidelines for activities



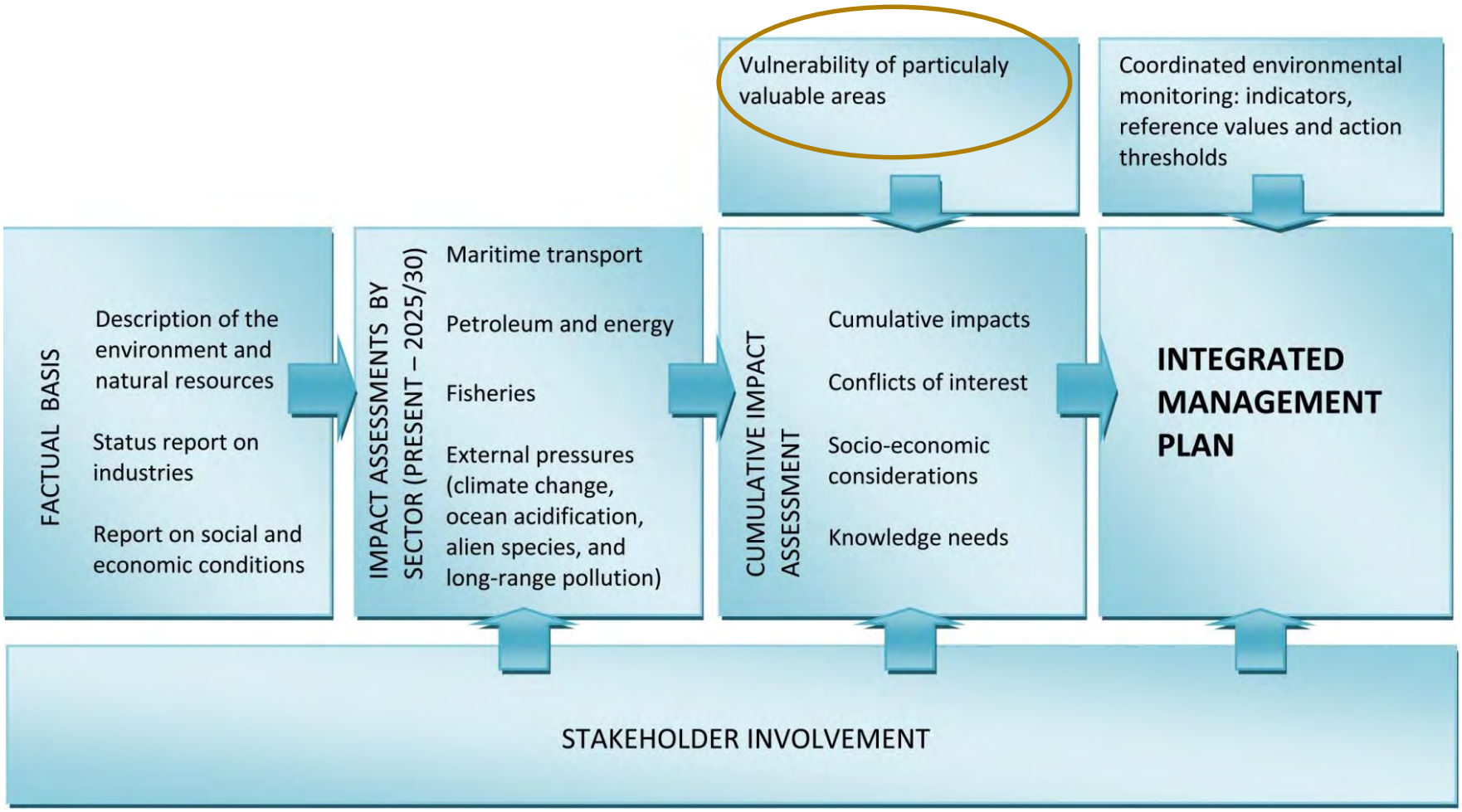
Help achieve consensus about the management

Identify gaps in knowledge

Setting the levels for acceptable influence by human

Make guidelines for monitoring

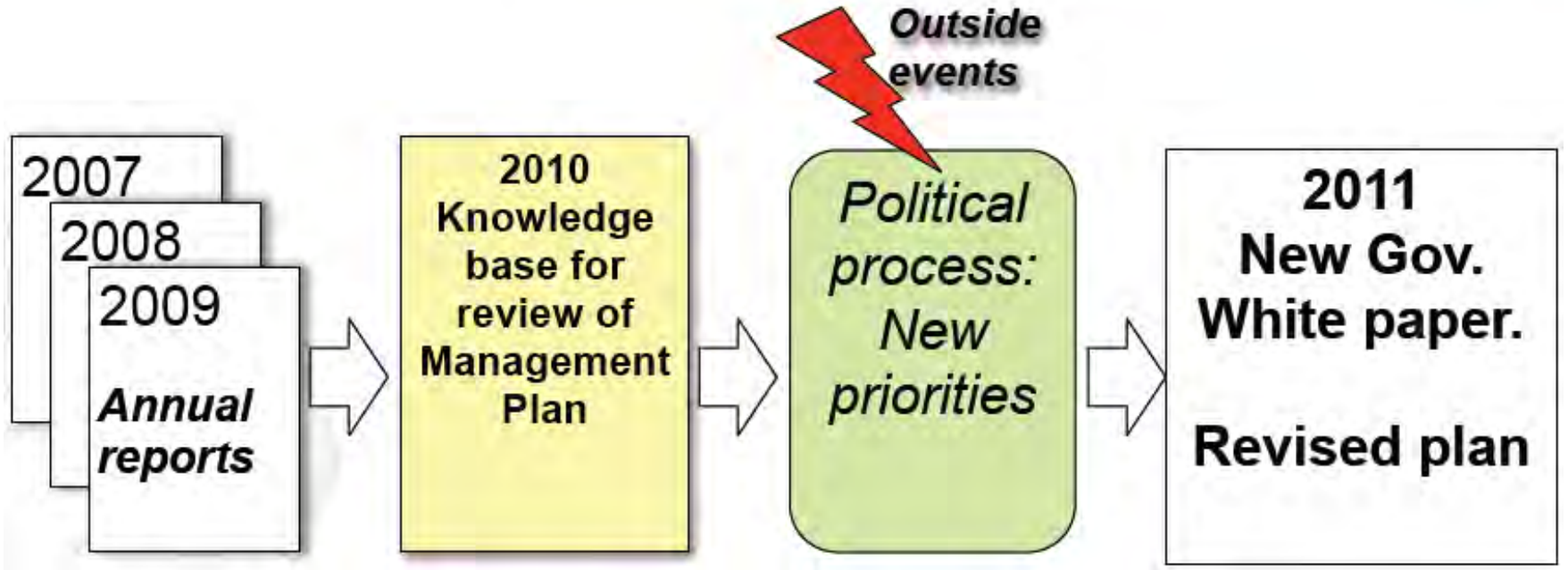
The different steps of the Integrated Management Process – a cross-sectoral process



Update

The Integrated Management Plans are to be updated on a regular basis.

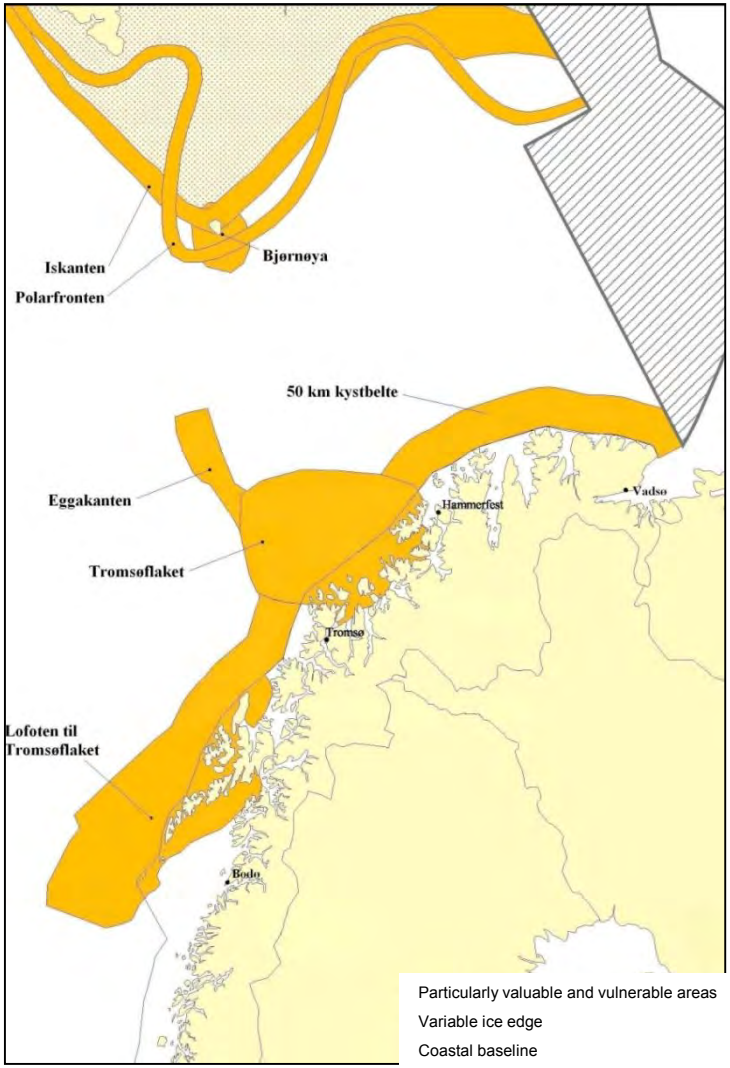
E.g. the Barents Sea:
- First update: spring 2011.
- A complete revision of the whole management plan within 2020.



Courtesy: A.H. Hoel

Particularly valuable and vulnerable in the management plan

Particularly valuable and vulnerable areas that require special attention (in the Management Plan/White Paper)



The most important criteria for selecting the areas were:

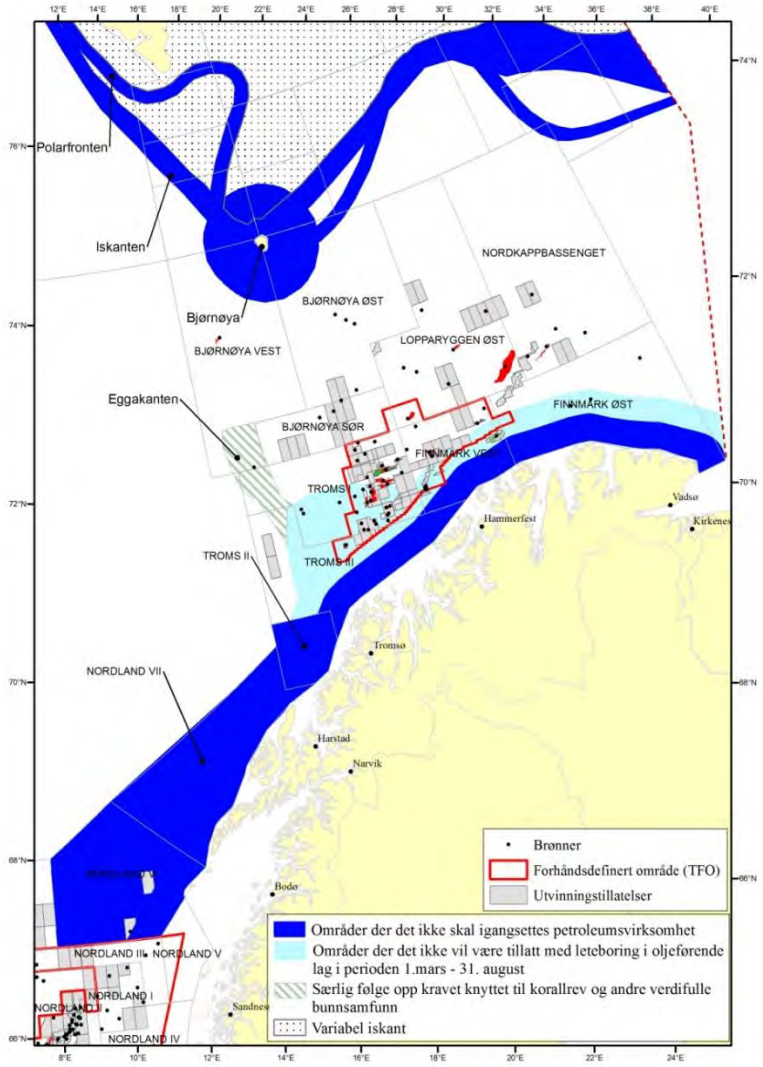
- whether it supports **high production** and ***high concentration*** of species

- whether it includes a large proportion of ***endangered*** or ***vulnerable*** habitats

- whether it is a ***key area*** for species for which Norway has a special responsibility or for endangered or vulnerable species

- whether it supports ***internationally*** or ***nationally*** important populations of certain species all year round or at specific times of the year

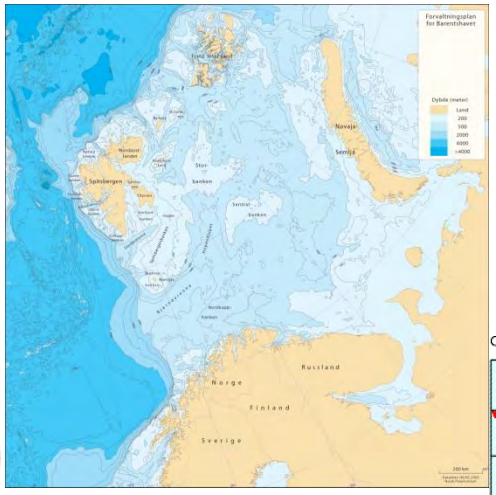
Framework for petroleum activities

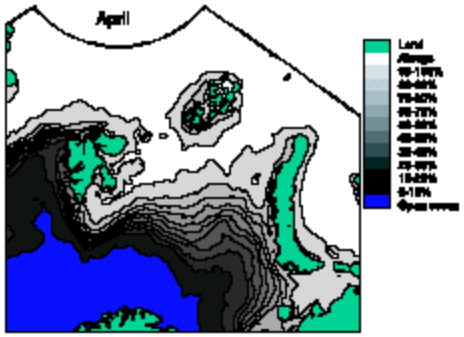


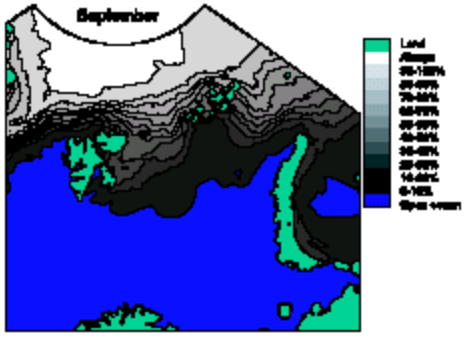
Physical and biological environment

The ocean environment

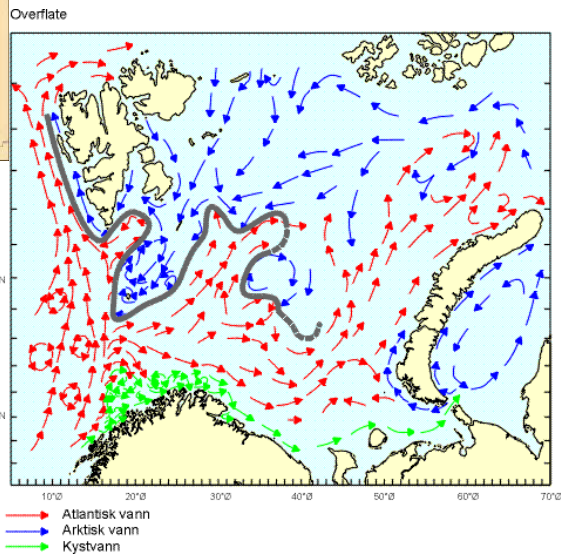
- Ocean currents
- Water masses
- Vertical mixing – stability
- Sea ice
- Ocean floor topography/condition
- Fluctuations (seasonal/between years)





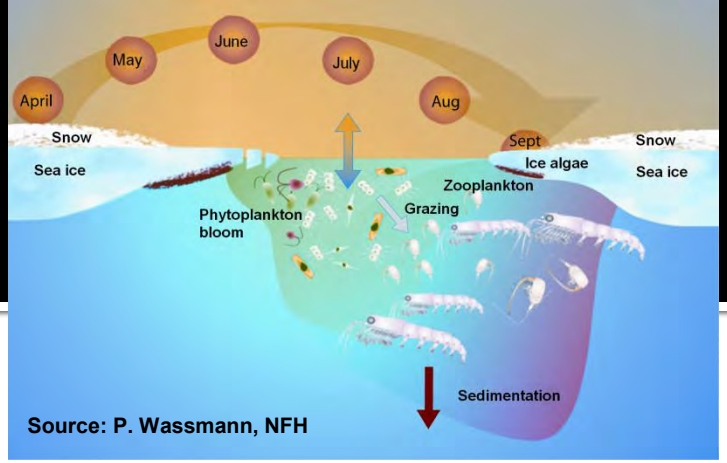


The probability for ice in April and September

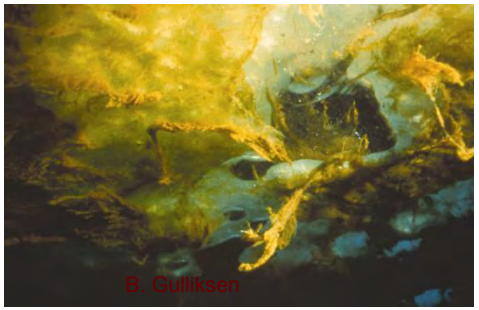


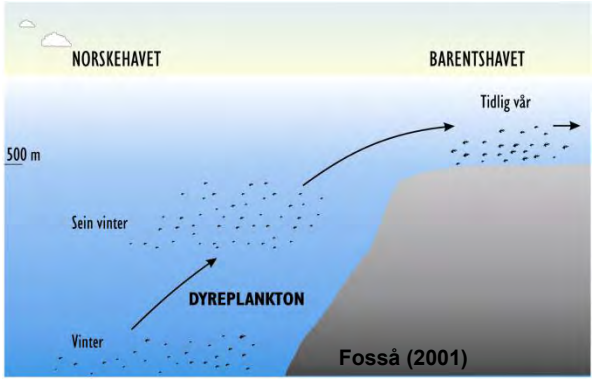
Surface currents: Lofoten–Barentshavet

Productive areas



- Bank areas, mixing – new nutrients + enough light
- The Marginale Ice Zone
- Polar Front
- Glacier fronts
- Polynyas
- Transport of organisms to the area

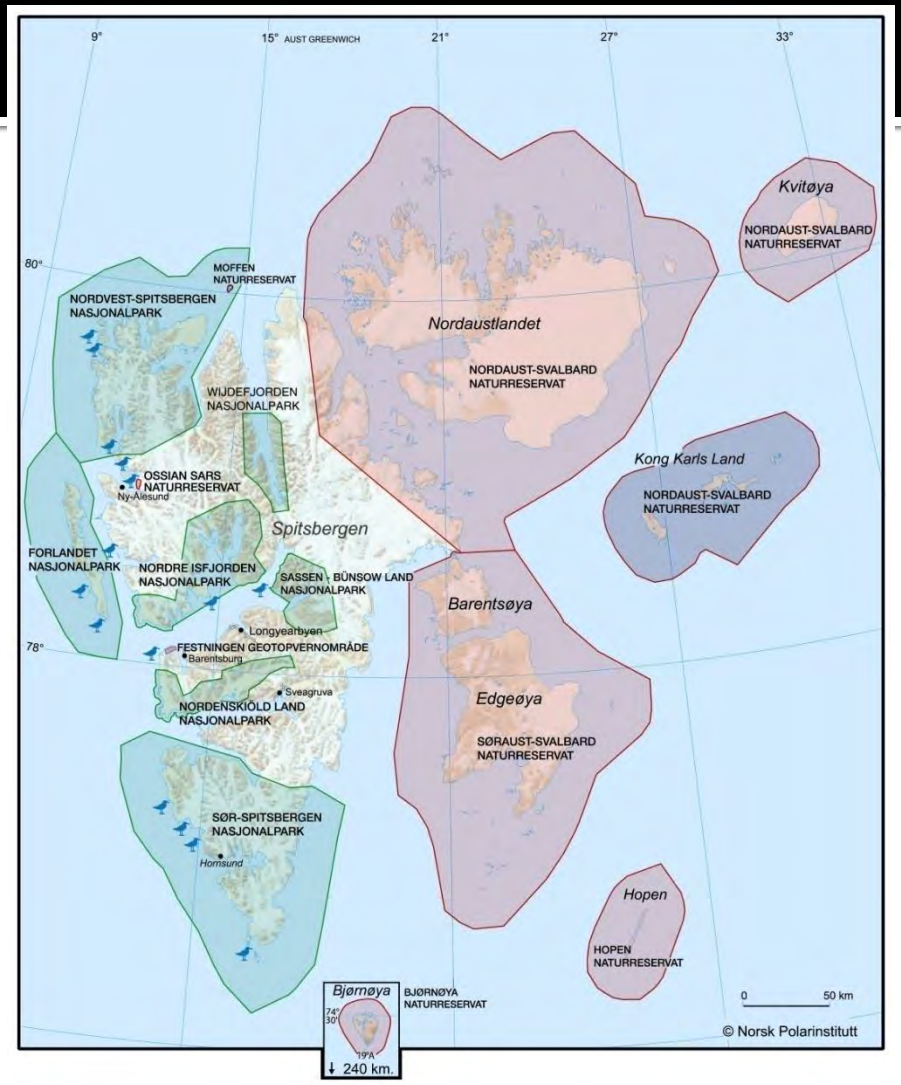




Other management areas

Photo: B. Gulliksen & E. Svensen (2004)

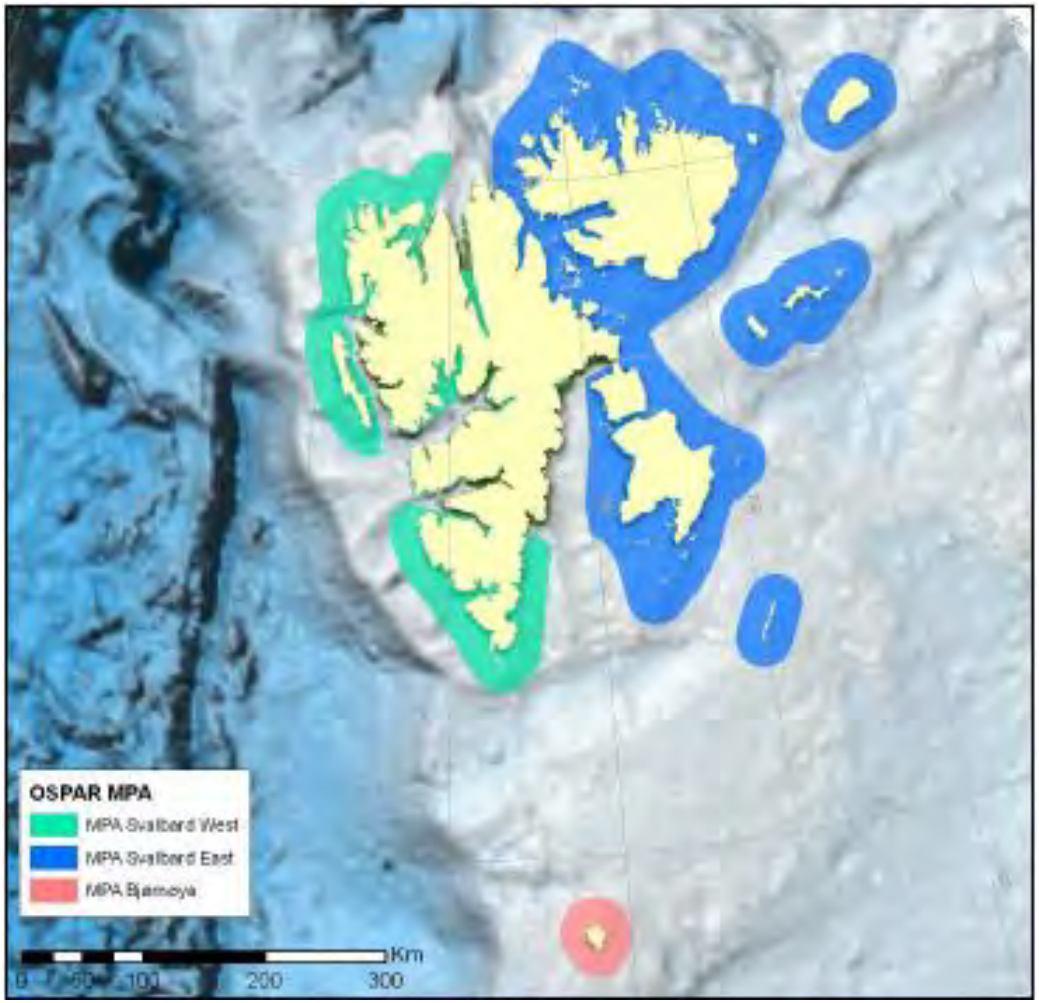
Protected areas in Svalbard



Protected areas cover 65 % of Svalbard, either as national park or as nature reserve.

The protection is stretching out to the territorial boundary (12 nautical miles) thereby including large marine areas of very different quality.

OSPAR Marine Protected Area (Svalbard, Norway)

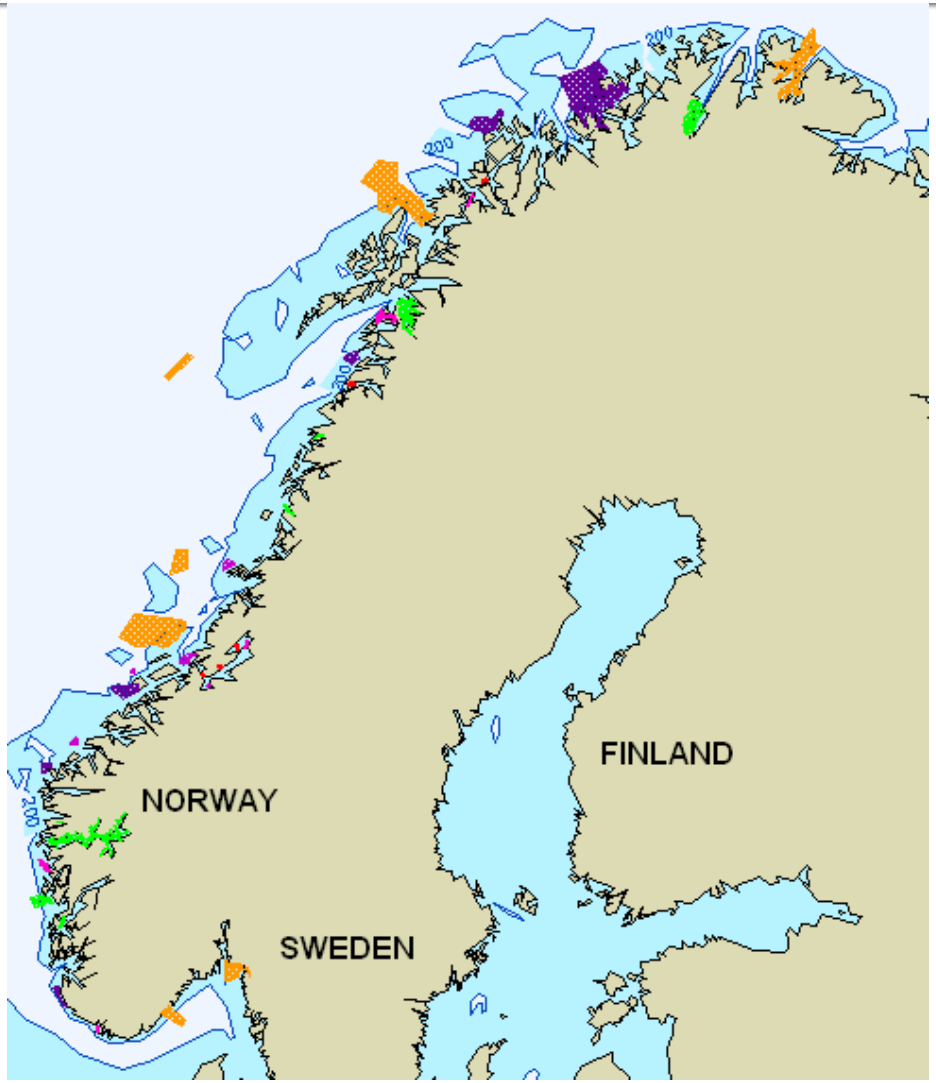


Selection criteria

- Threatened and/or declining species and habitat
- Important species and habitats
- Ecological significance
- High natural biological diversity
- Representativity
- Sensitivity
- Naturalness

Development of national plan for MPAs

- Analysis: distribution of plants and animals along the coast (4000 benthic species)
- 3 biogeographic regions
  - Skagerrak in the south
  - Norwegian west coast
  - Finnmark in the north
- 6 categories of areas
  - 1. Landlocked fjords 2. High-current areas, limited water exchange trough a narrow passage/channel 3. Shallow-water areas 4. Fords 5. Open coastal areas 6. Transects coast /ocean and continental shelf areas)
- Areas from all the 6 categories in each region selected
- National goal: Protect a representative selection of nature types, habitats and landscapes



Source: Egil Roll/www.milodir.no

Valuable areas (background - management plan)

Criteria

- Representativity
- Biodiversity
- Production
- Coupling: marine – terestric
- Naturalness
- Uniqueness and/or rarity
- Economic importance
- Social importance
- Scientific importance
- Educational value
- Accessibility
- International or national significance

Tabell 21. Utvalgskriterier for vurdering av marine natur- og kulturverdier brukt i MABA. Omarbeidet etter Theisen (1997), Gabrielsen et al. (1997), DN (1998), Theisen & Brude (1998), Hop et al. (1998), Kelleher (1999). Eksemplene som er nevnt under de ulike delkriteriene er ikke fullstendig. * Er forklart nærmere på neste side.

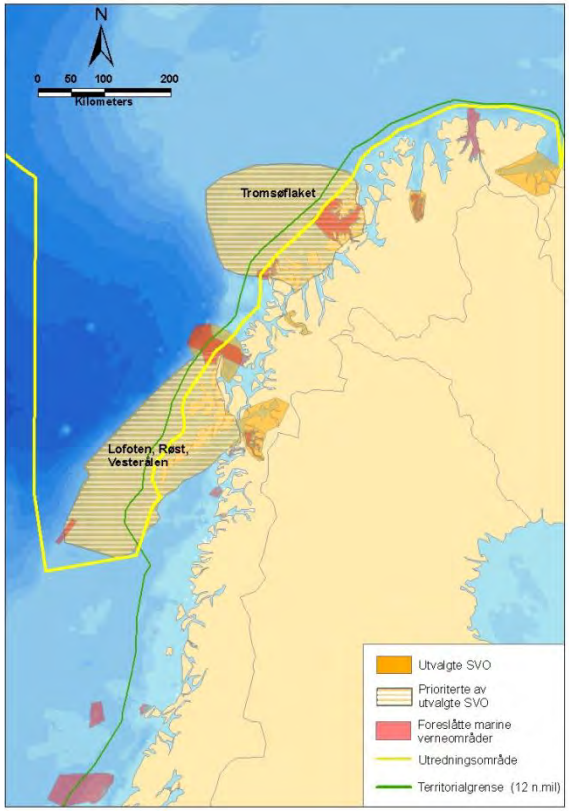
Utvalgskriterier		Delkriterier	Detaljer	Noen eksempler
Overordnet kriterium	· Viktighet for representasjon av alle biogeografis e soner, naturtyper, habitater, arter og kulturminner i analyseområdet	· Sikre representasjon som er typisk	· Vanlig forekommende · Unikt område, representativt for regionen · Områder som har bevart sin opprinnelige karakter	· Iskanten · Polynyaer · Fuglekolonier · Isskuringsområde
		· Sikre representasjon som er særegen	· Sjeldne naturkvaliteter · Områder med innhold truet av menneskelig virksomhet · Spesielt betydningsfulle arter	· Områder nær bosetninger · Områder med stor turistaktivitet · Områder med fis eriaktiviteter
		· Sikre representasjon innenfor et større nettverk	· Cirkumpolart i Arktis · Nord-sør gradient	
Utfyllende kriterier	· Viktighet for biologisk mangfold	· Spesielt stort biologisk mangfold (diversitet)	· Økosystemnivå · Artsnivå · Genetisk nivå	· «Hot-spots»
		· Leveområder for spesielle arter/bestander	· Endemiske arter · Sårbare, sjeldne, truede arter * · Økologiske indikatorarter * · Nøkkelarter * · Paraplyarter * · Flaggskip * · Bestander med nasjonal eller internasjonal verneverdi	· Øyer/fuglefjell · Strandsonen · Drivisen · Åpent hav
		· Spesielle naturtyper og habitater	· Sjeldne · Truede · Sårbare	· Isolerte øyer
		· Grenseområder	· Yttergrense for en eller flere arters utbredelse	· Polarfronten
	· Viktighet for biologisk produksjon	· Stor biologisk produksjon	· Høy primærproduksjon · Høy sekundærproduksjon	· Upwellings- og frontområder · Iskantsonen · Permanent isfrie områder i drivisbeltet
		· Store konsentrasjoner av arter eller individer	· Reproduksjonsområder · Oppvekstområder · Nærings-, hvile- og myteområder · Kaste- og hårfellingsområder · Trekk- og vandringsruter	· Fuglefjell · Grunne områder/banker · Iskanten
	· Kobling mellom marint og terrestrisk miljø	· Grad av påvirkning fra marine organismer på terrestrisk miljø	· Vegetasjon ved fuglefjell · Næringsressurs	· Fuglefjell
	· Uberørthet	· Graden av menneskeskapt påvirkning	· Tekniske inngrep/arealbruk · Beskatning (fis e/fangst) · Forurensning	· Bentiske områder · Åpent hav · Områder nær bosetninger
	· Særegenhet og/eller sjeldenhet	· Naturverdier	· Særegne/Sjeldne naturtyper	· Kystklipper · Manglende strandterrasser · Enkelte bentiske områder?
		· Kulturminneverdier	· Særegne og sjeldne kulturminner	· Forlis iht. skriftlige kilder
	· Økonomisk betydning	· Turisme	· Områder med opplevelsesverdi	· Enkelte strandlokaliteter · Fuglefjell
		· Fiske/fangst	· Reproduksjonsområder · Oppvekstområder · Nærings-, hvile, myteområder	· Bentiske områder · Kystområder · Åpent hav
	· Sosial betydning	· Verdi for lokale/internasjonale samfunn	· Historisk verdi · Estetisk verdi · Verdi for rekreasjon	· Kystområdene · Kulturminner
	· Vitenskapelig verdi	· Spesielt vitenskapelig interessante områder/arter/økosystem	· Biologiske- · Geofysiske- · Geologiske forekomster og fenomener · Kulturminner	· Et vidt spekter av områder
		· Referanseområder · Kildeverdi	· Forskning · Overvåkning	· Et vidt spekter av områder
	· Pedagogisk verdi	· Typelokaliteter	· Biologiske · Geologiske	· Et vidt spekter av områder
		· Illustrering av sammenhenger	· Økologiske · Naturfenomener · Kulturminner og naturmiljø	· Et vidt spekter av områder
	· Tilgjengelighet	· Vitenskapelig aktivitet · Pedagogisk aktivitet · Turisme/friluftsliv		
	· Internasjonal og/eller nasjonal verdi	· Eksisterende forpliktelser	· Ulike avtaler/forpliktelser · Internasjonale konvensjoner	· Et vidt spekter av områder
		· Potensiale for å bli innlemmet i et nasjonalt/internasjonalt system	· Ulike nettverk - verneområder - målestasjoner - forskningsprogram · Internasjonal/nasjonal verneverdi	· Et vidt spekter av områder

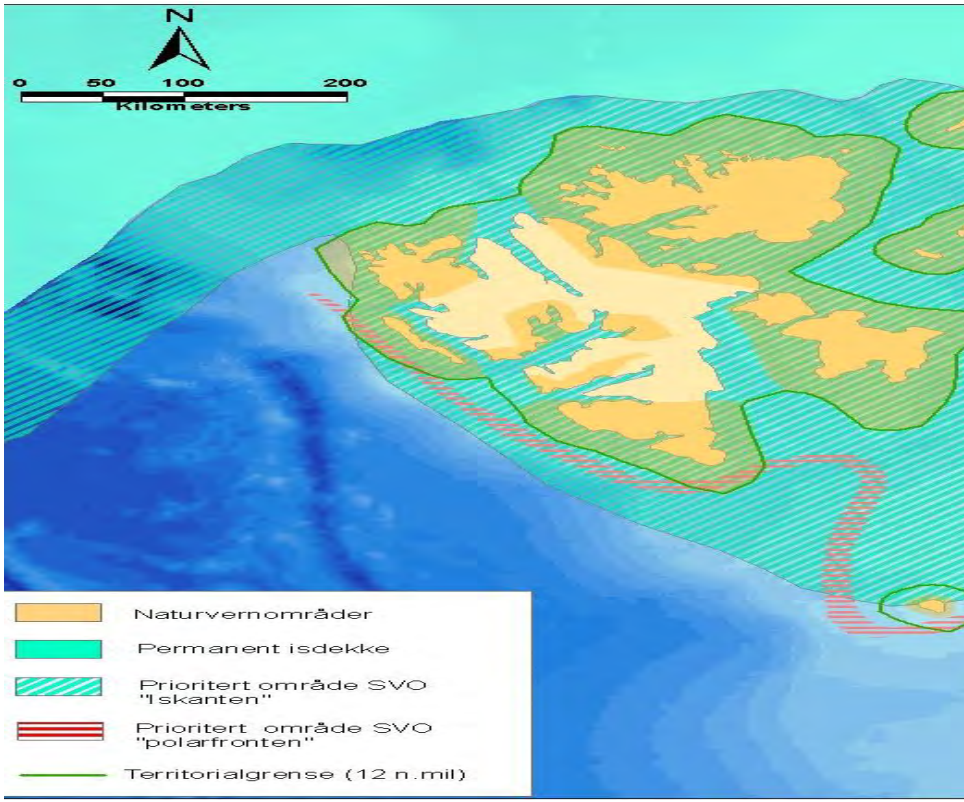
Selected valuable areas

- **Oceanographically/ topographically special areas**
  - Fronts
  - Strong currents
  - Fjords
  - Retention areas
  - Tidal zone
- **Important areas for life history**
  - Spawn/birth/breeding grounds
  - Drifting paths/migrating routs
  - Feeding grounds
  - Wintering grounds
  - Moulting areas
- **Other criteria**
  - Key areas for **endangered** or **vulnerable** species
  - or **species** for which Norway has a **special responsibility**
  - or **habitats** for **internationally** or **nationally populations** of certain species all year round or at specific times of the year

Particularly valuable areas in the Barents Sea

Lofoten/Røstbanken/Vesterålen, **Tromsøflaket**, the **Polar Front** and the **Marginal Ice Zone** are particularly valuable areas for **biological production** and **biological diversity**. Negative pressures will in some cases affect a great deal of a population or a great deal of the ecosystem.





Vulnerable areas (background - management plan)

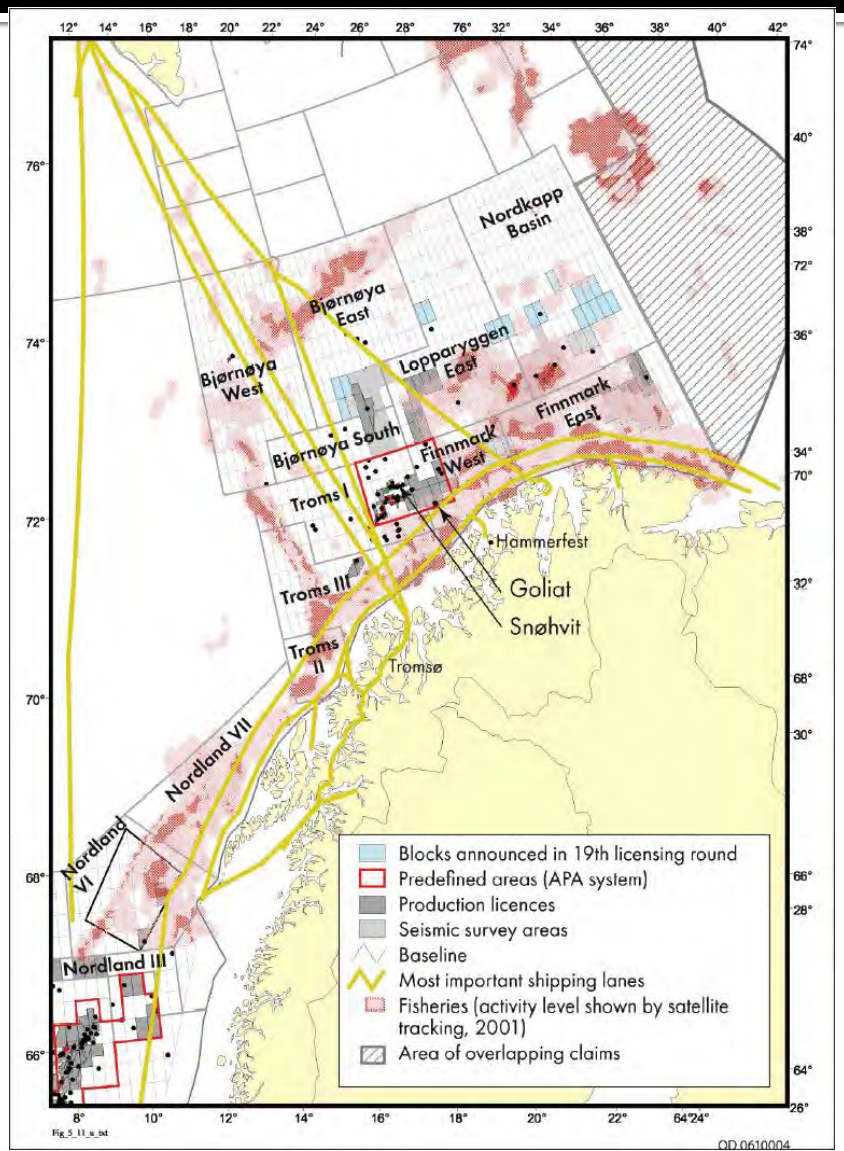
Vulnerability

Assessing vulnerability

- Type of impact and duration
- Differentiating between natural and human-induced pressures on the environment is difficult
- An area is usually not equally vulnerable all year round
- All species in an area will not be equally vulnerably towards a specific environmental pressure.

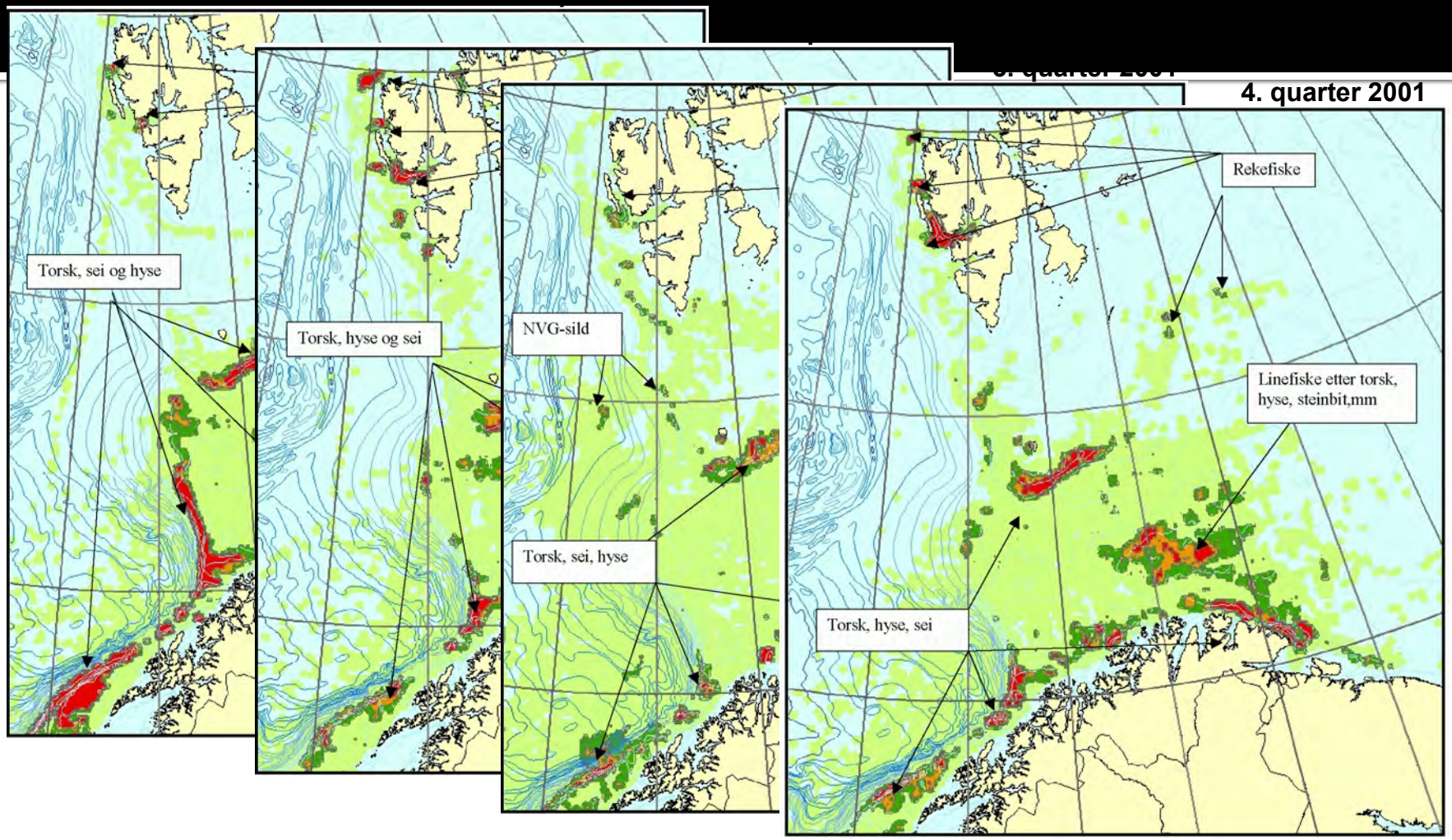
Vulnerability can be measured at individual, population, community and ecosystem level.

Overall pressures in the Barents Sea-Lofoten area

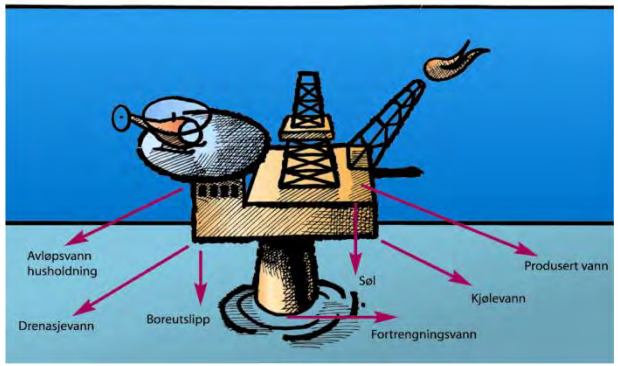


The state of the environment in the management plan area is ultimately dependent on the overall pressures and impacts of all the different activities that take place both within and outside this area.

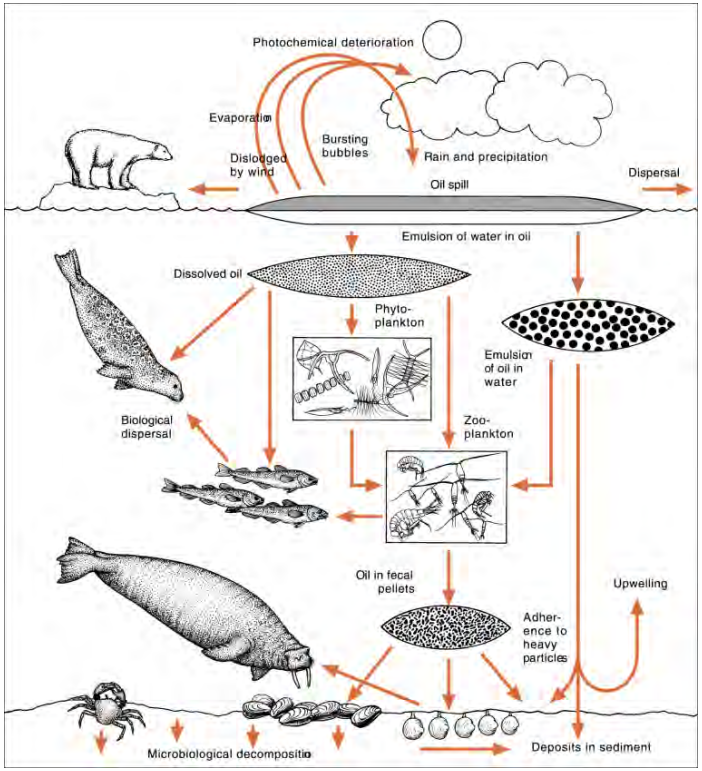
The fishery activity



Petroleum hydrocarbons



- Several components
- Types of spills
- Dispersal routes
- Environmental consequences



Vulnerability cont.

- **High concentrations of organisms**
  - Number of individuals within an area - influer on the vulnerability
    - High production – grazing areas
    - Breeding colonies
    - Haul out sites
- **Behavior or population dynamics**
  - Species being able to escape unfavorable conditions will be least affected
  - Time spent at sea for feeding or moulting
- **Sessile/motile animals**
  - Sessile animals – particular vulnerable with respect to climate change, pollution, certain types of fishing operations
- **Insulation**
  - Feathers and fur - more vulnerable to oil spills than whales and adult fish – amount of blubber
- **Diet**
  - The diet variability and degree of specialization
- **Key species**
  - Particular important role in the ecosystem
  - Seriously affected – may affect the whole ecosystem


Foto: H. Strøm


Foto: C.H. von Quintelt


Foto: B. Gulliksen & E. Svensen (2004)

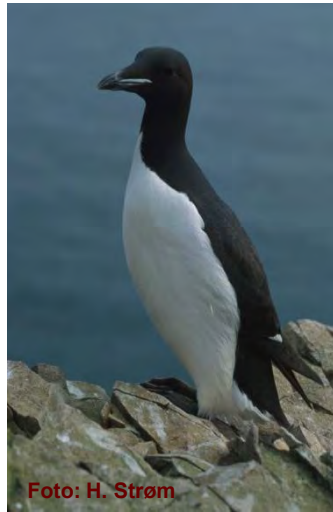
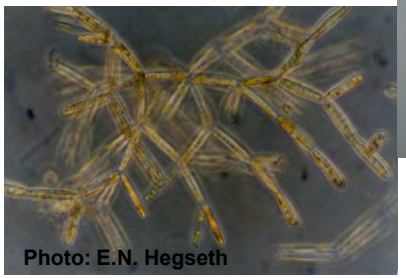


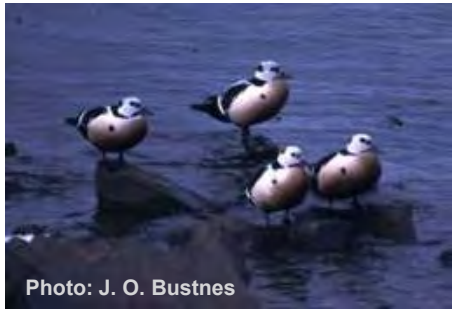
Foto: H. Strøm


Foto: H. Hop

Vulnerability cont.

- **Age**
  - An organism's vulnerability varies in accordance with age
  - Generally, the young stages of an organism's lifecycle will be especially vulnerable
    - immune, neural, enzyme systems are developed
- **Life history**
  - How long they live
  - When they sexually mature
  - Reproductive rate
- **Migration**
  - Whole life or migrate in and out of the area
- **Border of distribution**
  - Often more vulnerable near its border of distribution
- **Peculiar species composition and/or particularly high species diversity**
- **IUCN Red List species.**
  - Essentially a forecast of the risk of species becoming extinct in Norway.





Particularly vulnerable areas

Barents Sea: An evaluation of environmental values and vulnerability with respect to the most important impacts of fisheries, shipping and petroleum activity, resulted in a list of **16 vulnerable areas/types of areas**, of which **seven** were regarded as **particularly vulnerable**.

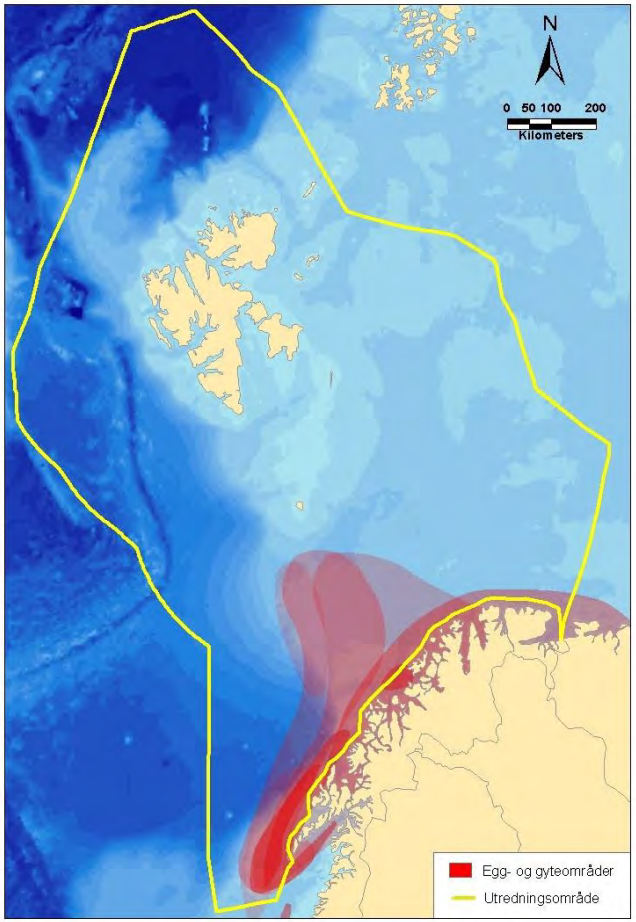

Photo: N. Øien

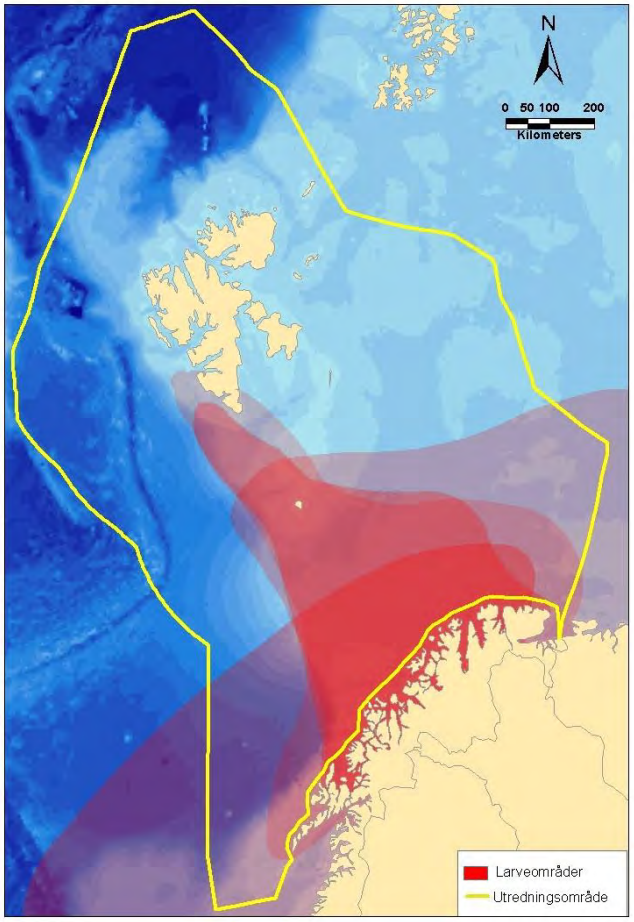
- Particularly valuable areas
- Spawning and egg grounds for fish
- Larva grounds for fish
- Breeding, feeding, moulting and wintering grounds

Spawning, egg and larval grounds for fish

Egg/ spawning

1. and 2. quarter



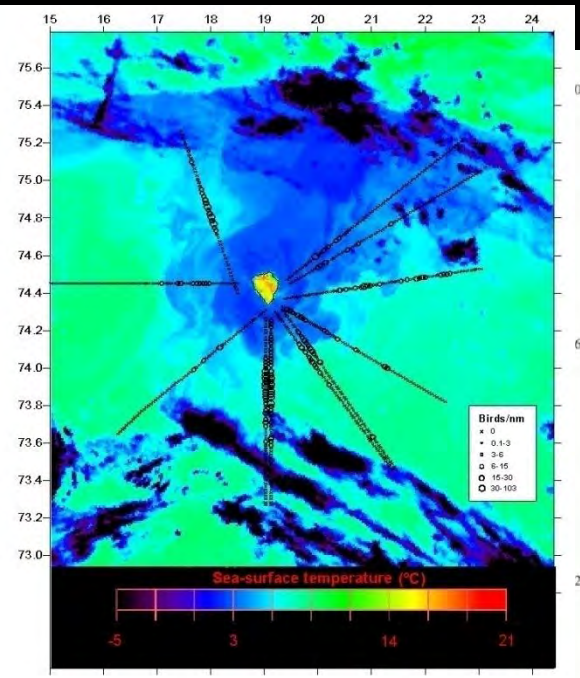


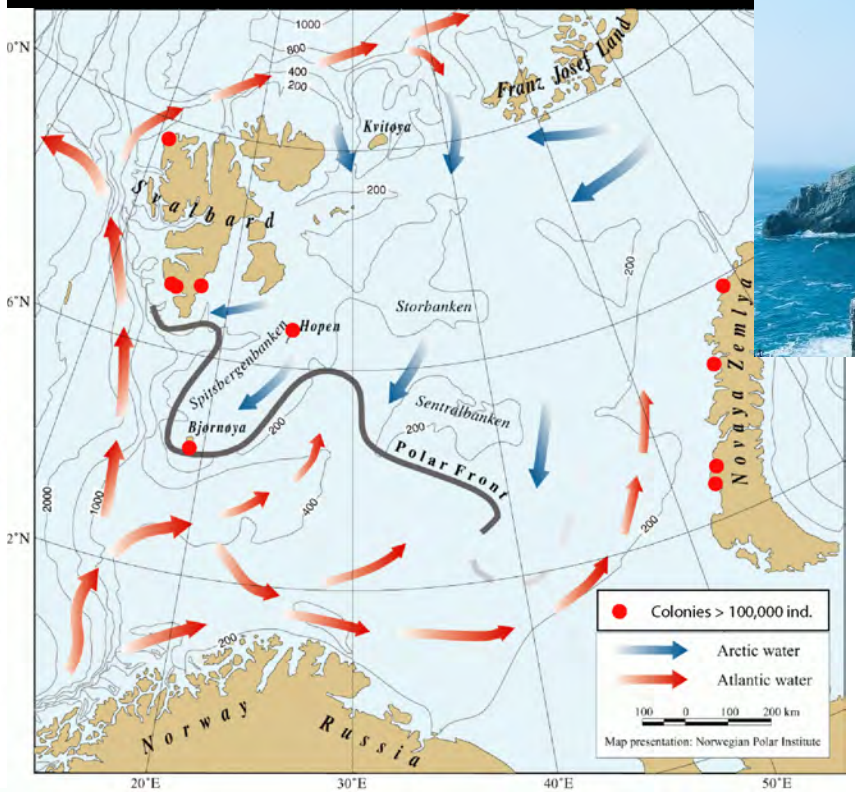
Larva

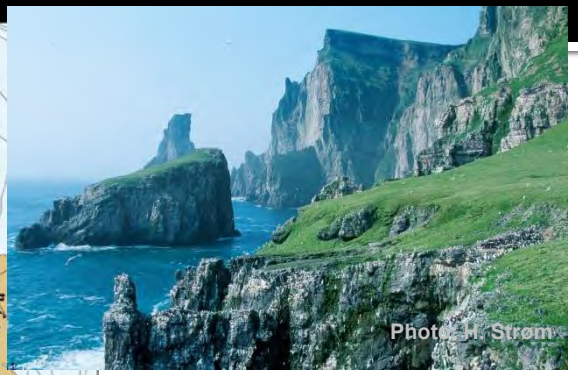
2. and 3. quarter

Eggs and larva are the most vulnerable stages of fish. Therefore, areas having high concentrations of eggs and larva of cod, haddock, herring and capelin are the most valuable for these species in the Lofoten-Barents Sea. The darker the color, the more overlap between species.

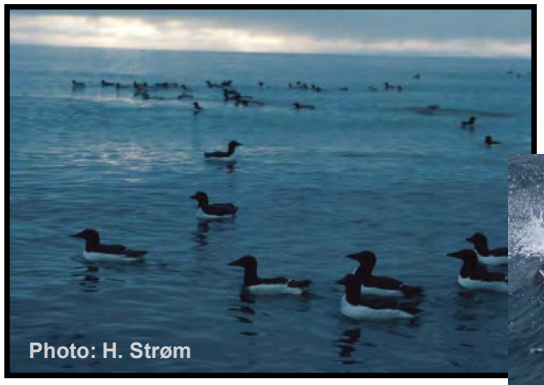
The Polar Front – important feeding area for seabirds and marine mammals







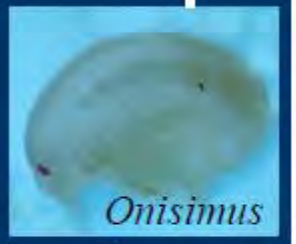
Bjørnøya – some of the biggest nesting colonies in the Barents Sea Region and in the North-Atlantic.



The Marginal Ice Zone (MIZ) as a valuable and vulnerable area

Courtesy: D. Vongraven, NPI

Marginal ice zone food web



Ice POM

Pelagic POM

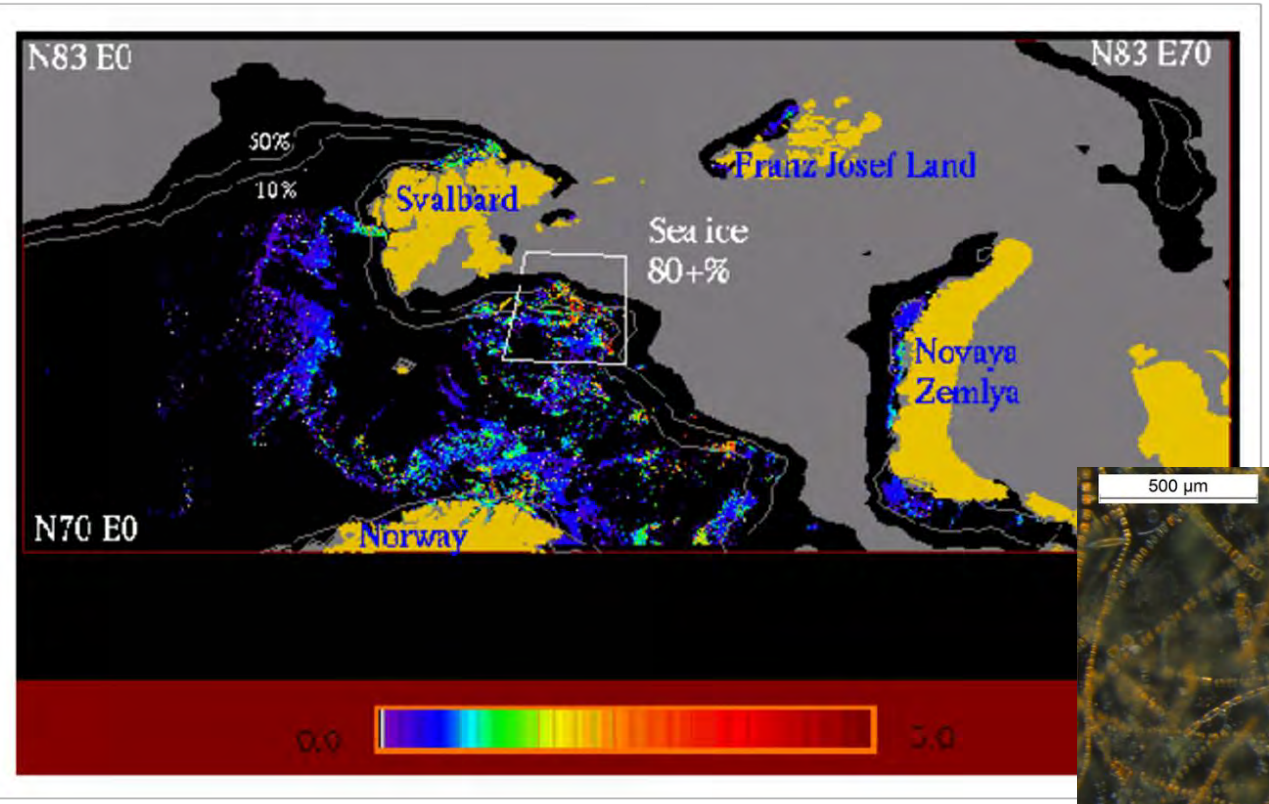
Courtesy; J. Søreide, UNIS

Values

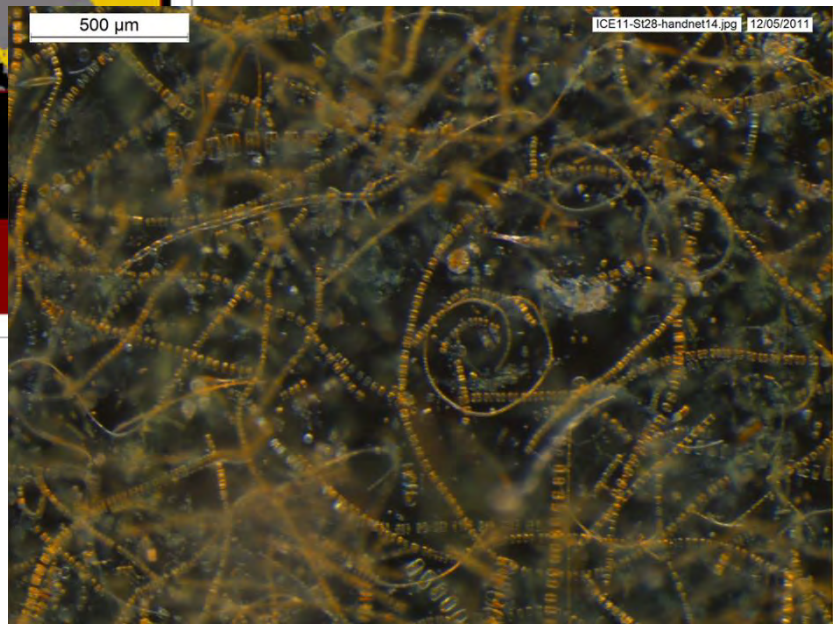
MIZ – high primary production

In the ice

MIZ - a short, but intense primary production

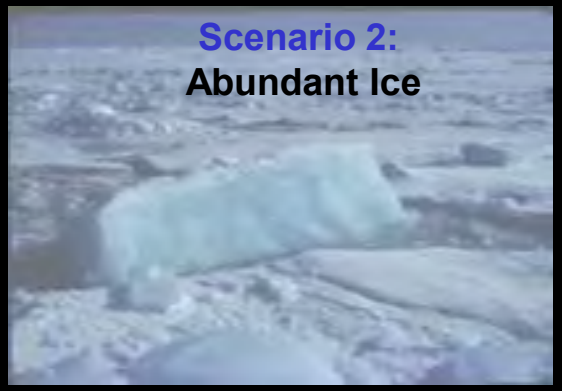


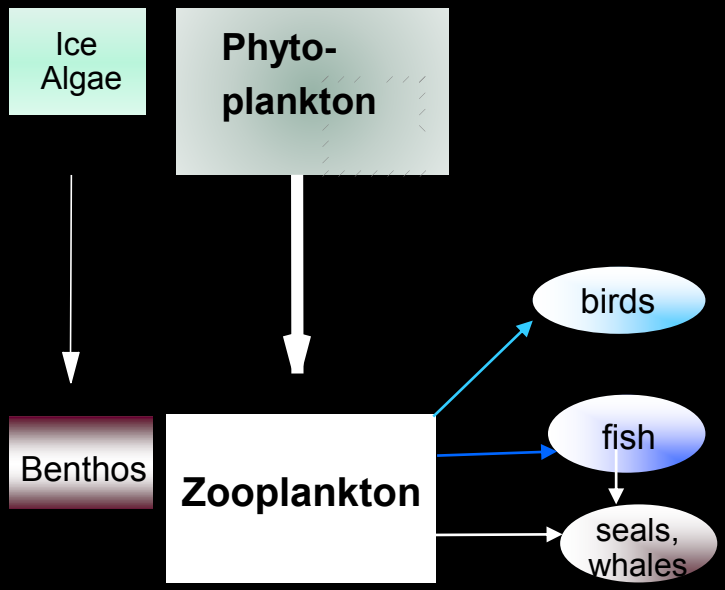
In the water

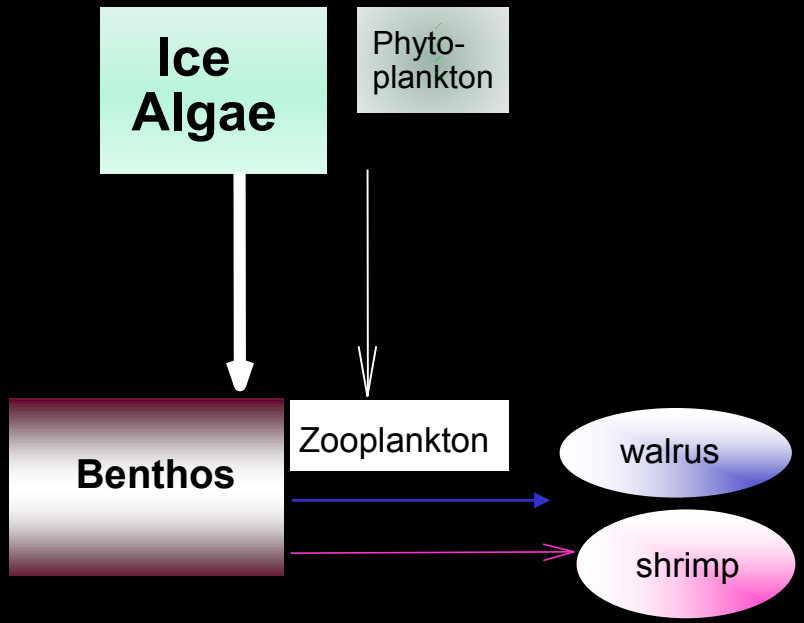


The MIZ – important feeding area for fish, seabirds and marine mammals

Pelagic-benthic coupling







Carroll & Carroll (2003)

Movement, mating, denning, haul out .....


Photo: Kit & Christian, NPI

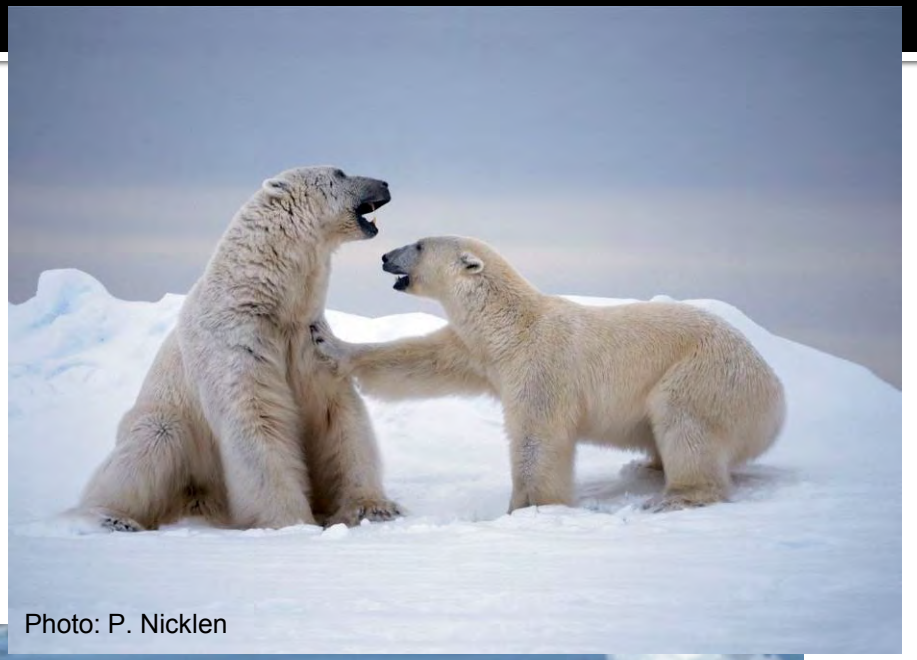


Photo: P. Nicklen

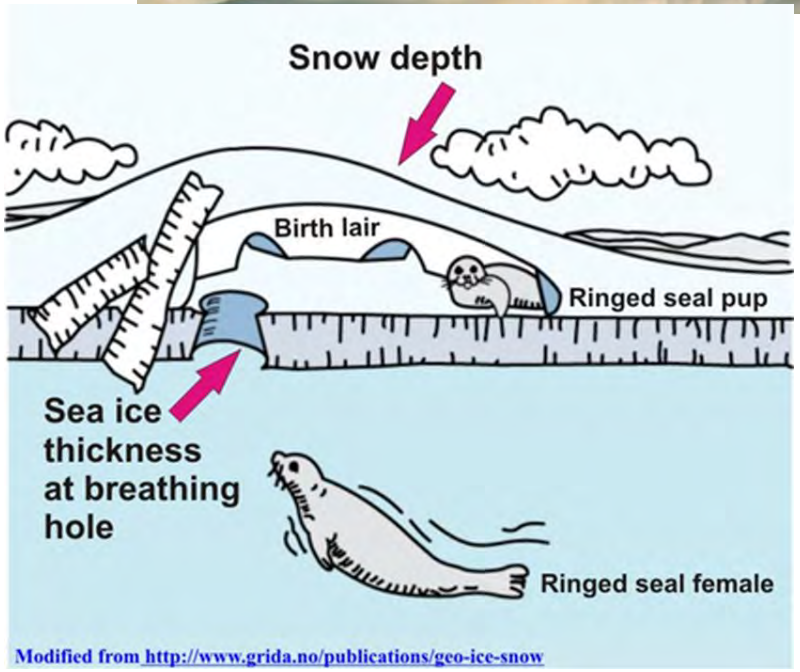



Photo: G. Bangjord

Border of distribution

Ringed seal

Nitzschia frigida

Gammarus wilkitzkii

Endangered and vulnerable species, key species .....


Photo: G.W. Gabrielsen, NPI


Photo: B. Frantzen


Photo: pinterest.com


Photo: J. Aars, NPI


© Peter Leopold 2015

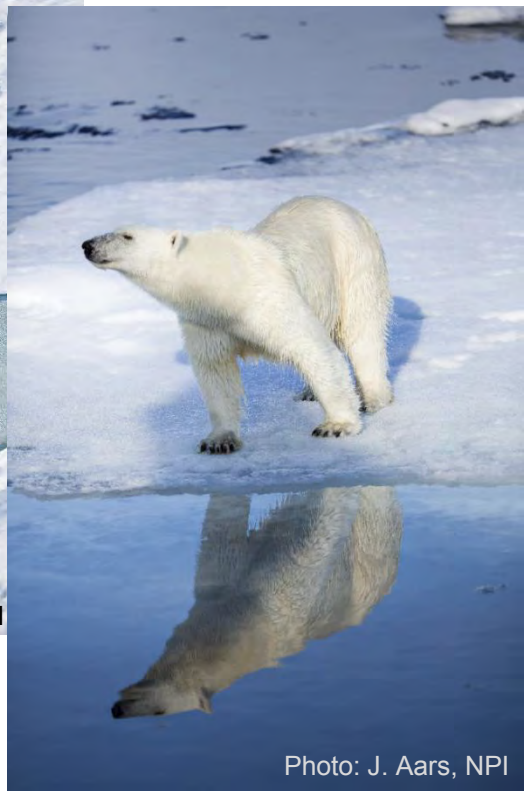


Photo: J. Aars, NPI

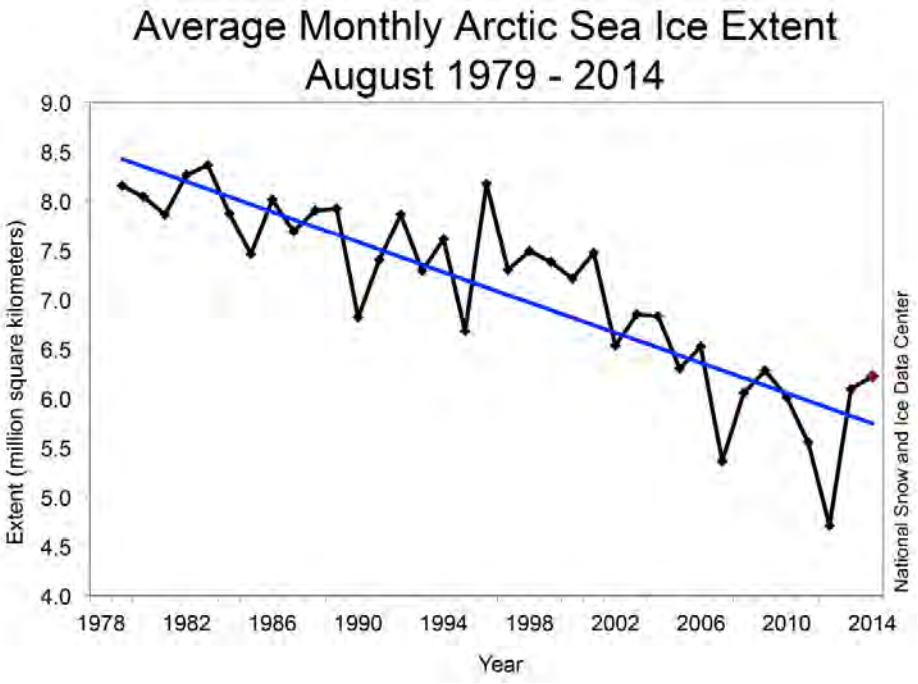
Impacts

Change of sea ice extent, age and thickness


Pressure ridges


Multi-year ice

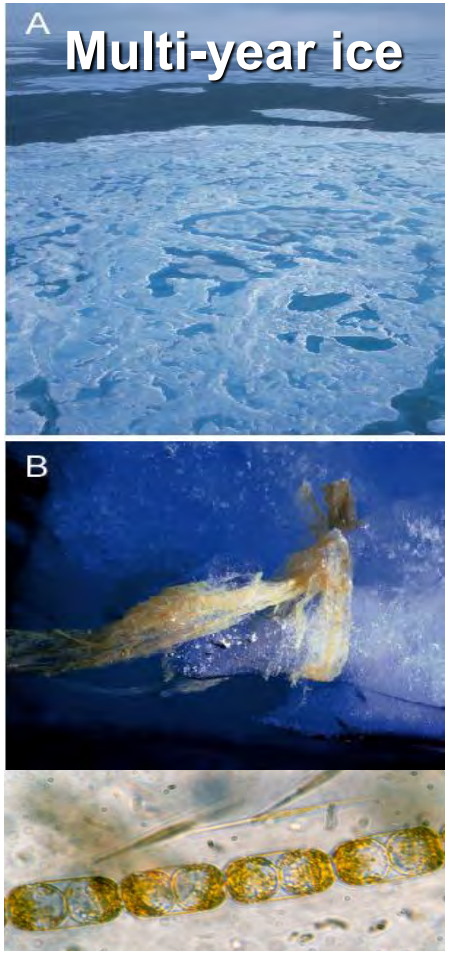

Compact one year old ice



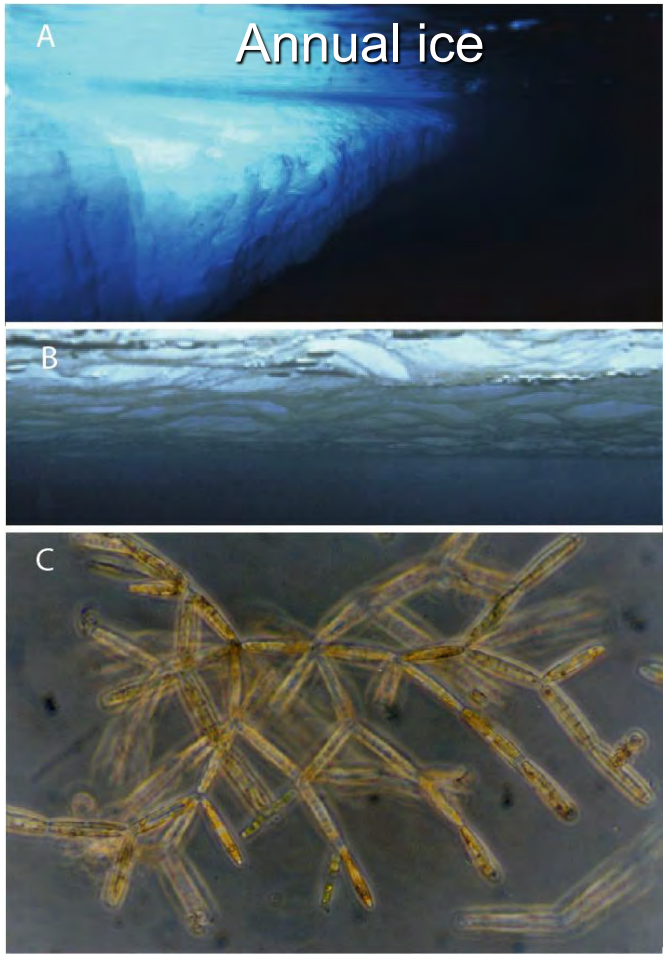

Drift ice

Photos: B. Fossli Johansen, C. von Quillfeldt

Climate change: different species communities



Melosira arctica



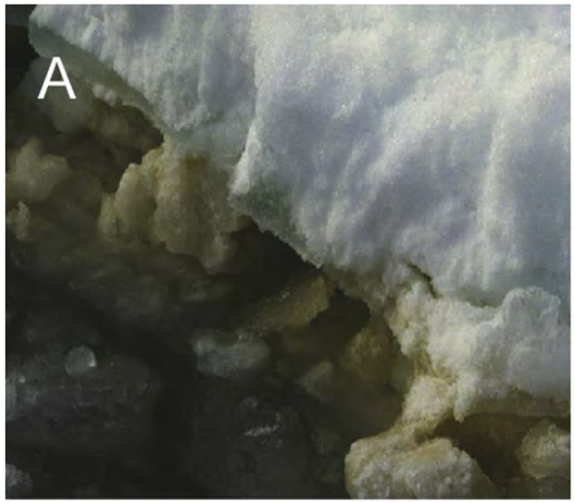
Nitzschia frigida

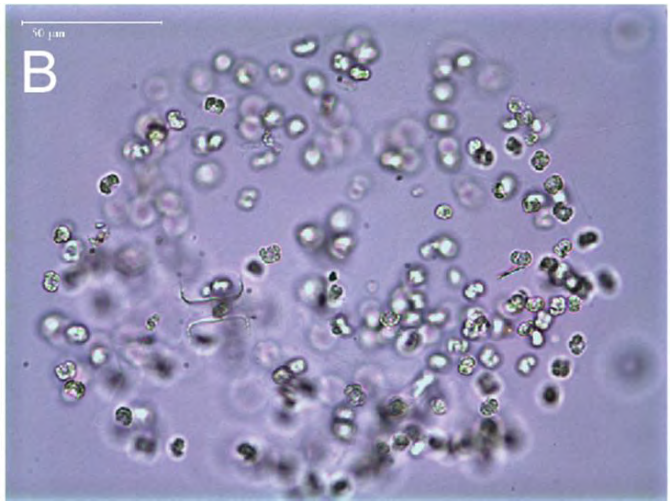
Photos: G. Johnsen, E.N. Hegseth, B. Gulliksen

Climate change: different communities

Infiltration community

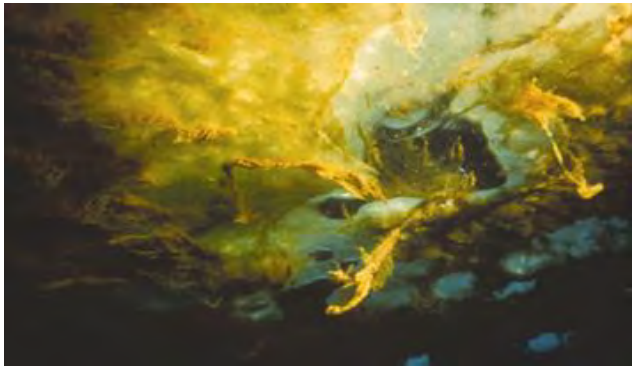
+





Sub-ice community

–



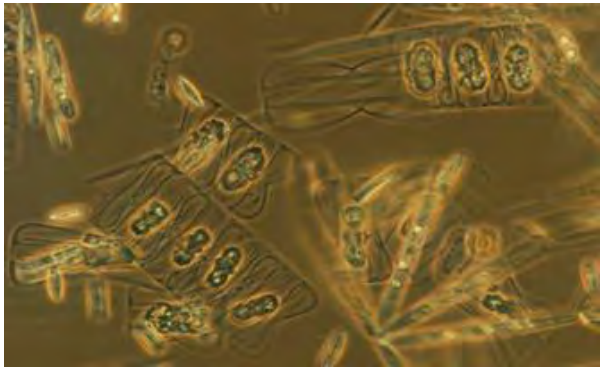


Photo: E.N. Hegseth, E. Leu, B. Gulliksen, C.H. von Quillfeldt

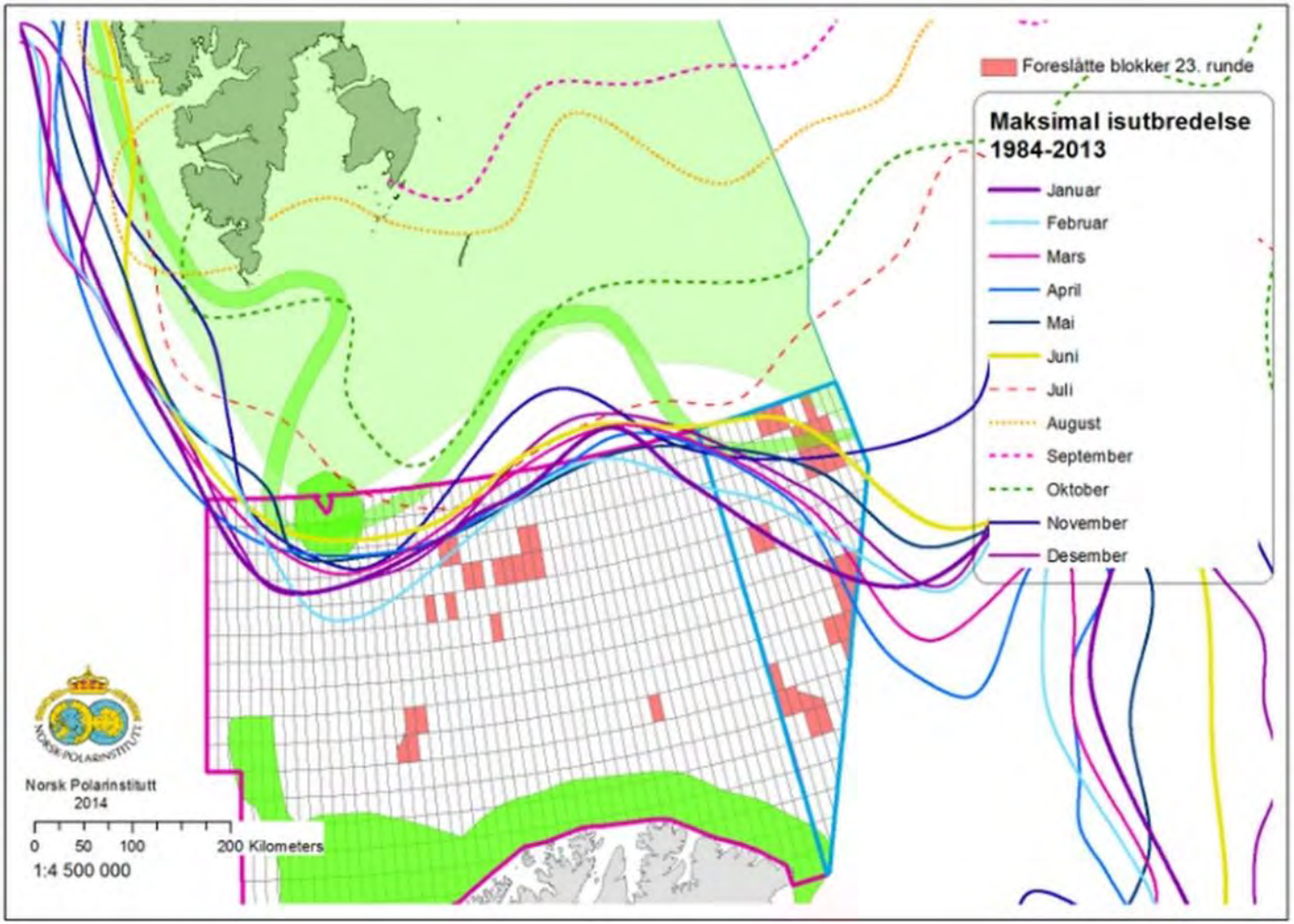
Potential oil spills


Photo: B. Gulliksen


Photo: J.-A. Røyset


Photo: B. Frantzen

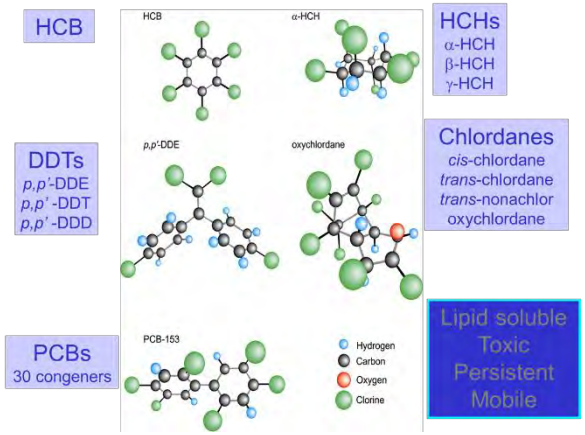
The marginal ice zone – a management challenge



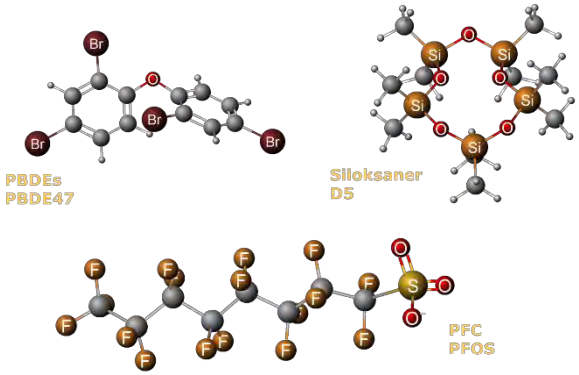
Pollutants

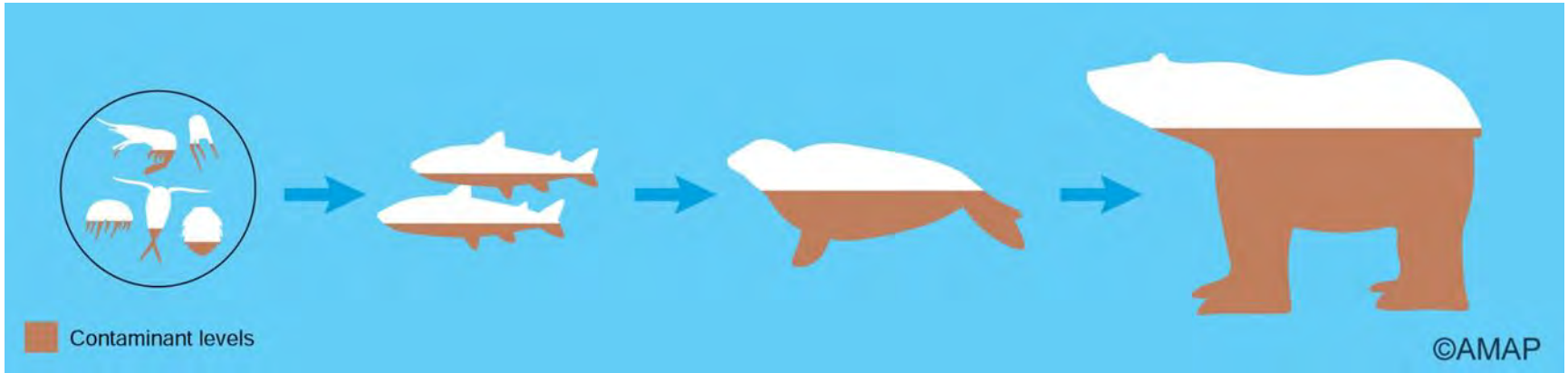
Sea ice

«Common» pollutants



«New» pollutants

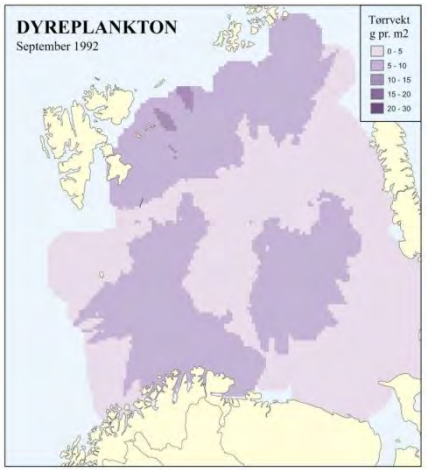


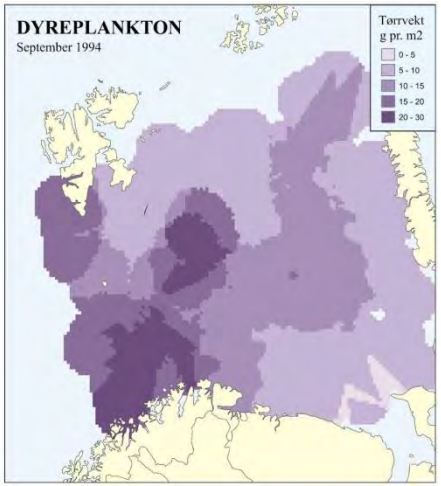


"Challenges"

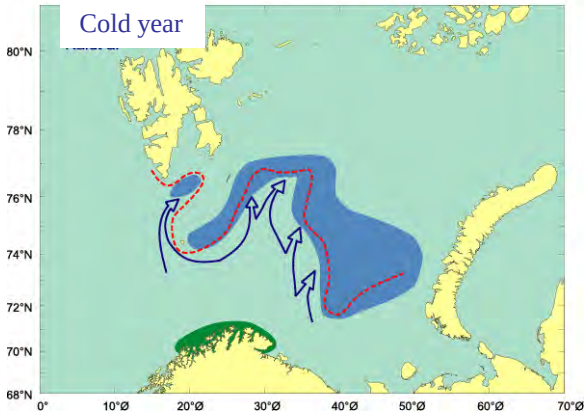
Unstable environment
Seasonal and annual variations

- **Physical factors**
  - Volume and heat transport
  - Ice conditions
  - Wind
  - Clouds
  - Light
  - Nutrients
- **Biological factors**
  - Primary production
  - Pray
  - Predators





Zooplankton – horizontal distribution

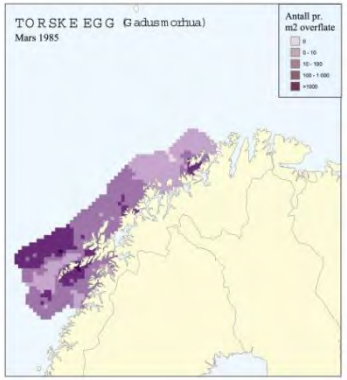


Distribution of capelin – warm/cold year

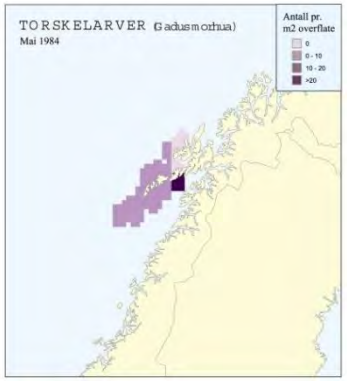
Source: IMR

Northeast Arctic cod

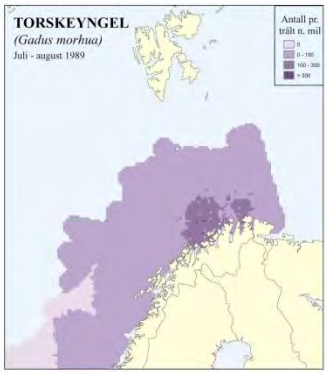
Eggs

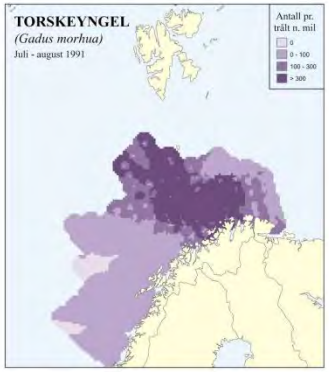


Larvae

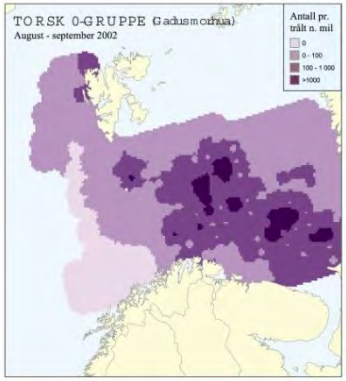


Fry

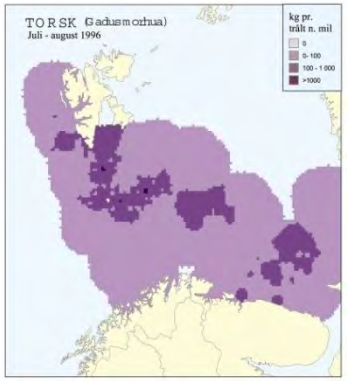


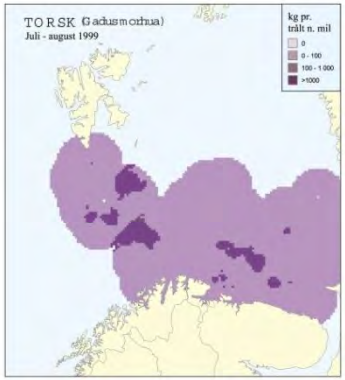


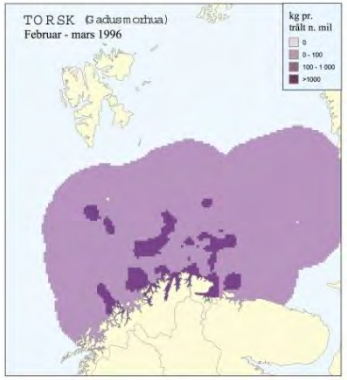
0-group

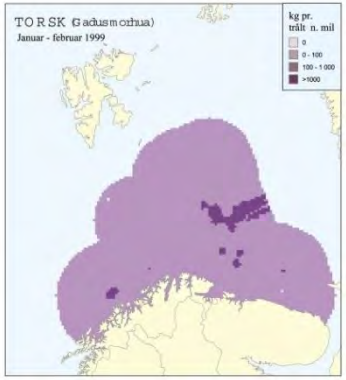


Adult

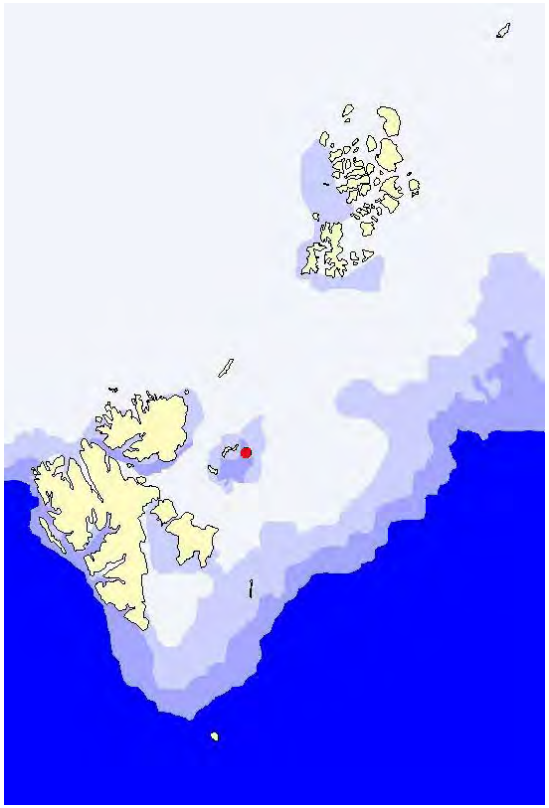


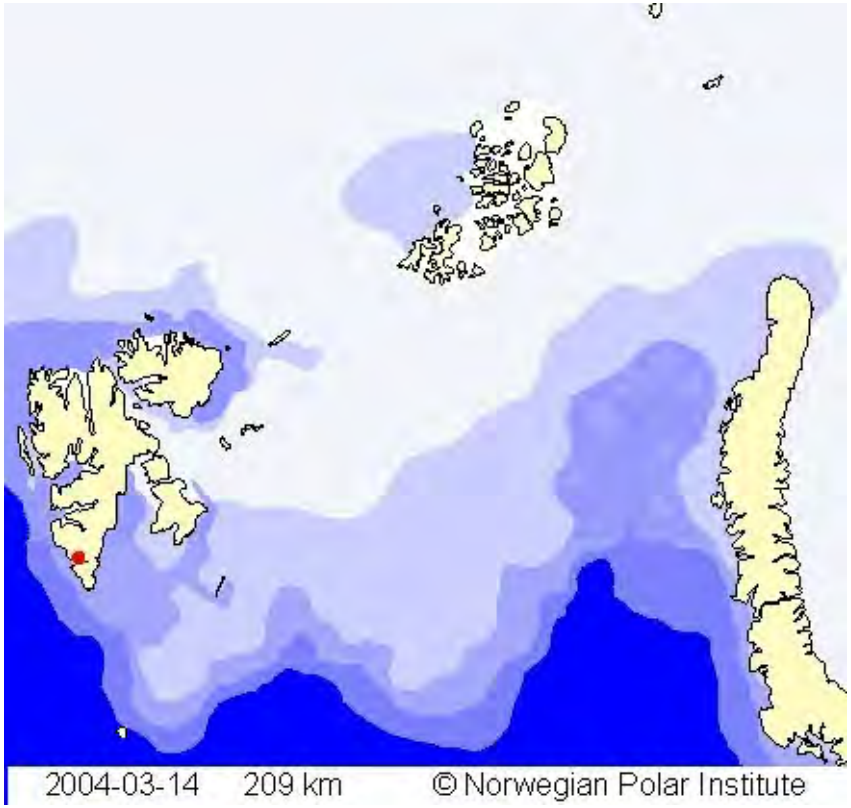






Some polar bears have small and/or large distribution areas



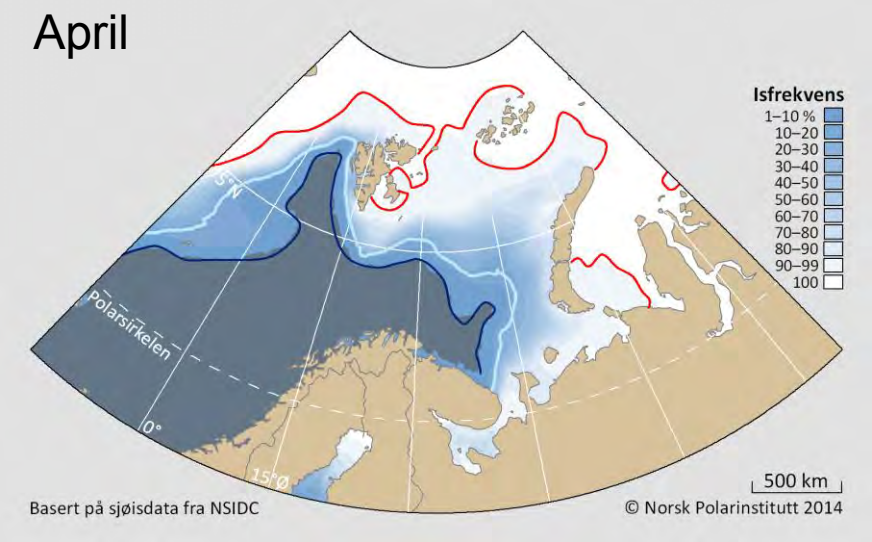


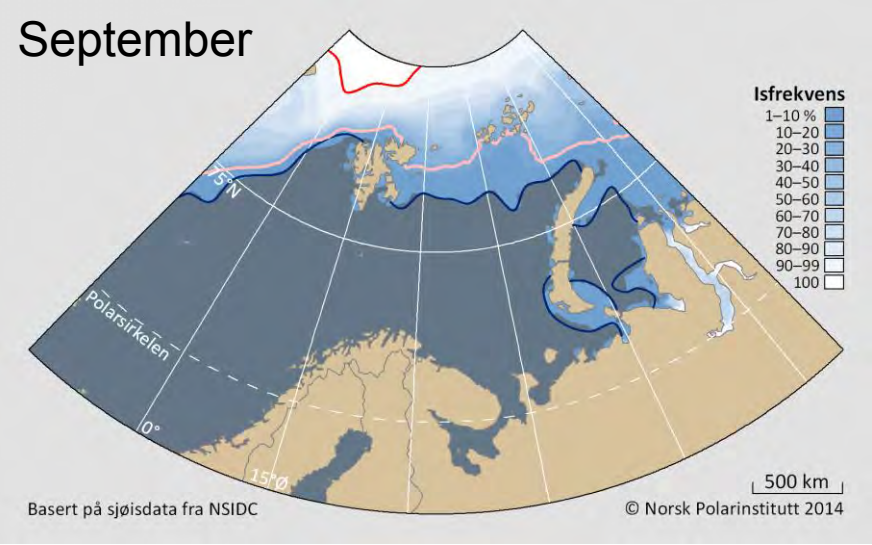
Migration

Source: Strøm et al. (2010)

«New» issues since last update

- Biological consequences of different ice conditions (distribution and quality) since last update
- More detailed information
  - Occurrence, functions, processes etc.
  - Variations within and between years
- Black carbon
- Fisheries
  - In/close to MIZ
  - New areas
- More focus on cumulative impacts
- Future changes in ice conditions and their ecological impacts





Thank you for your attention!

Photo: C.H. von Quillfeldt