

OIL & GAS

Species vulnerability and their use in oil spill risk assessments

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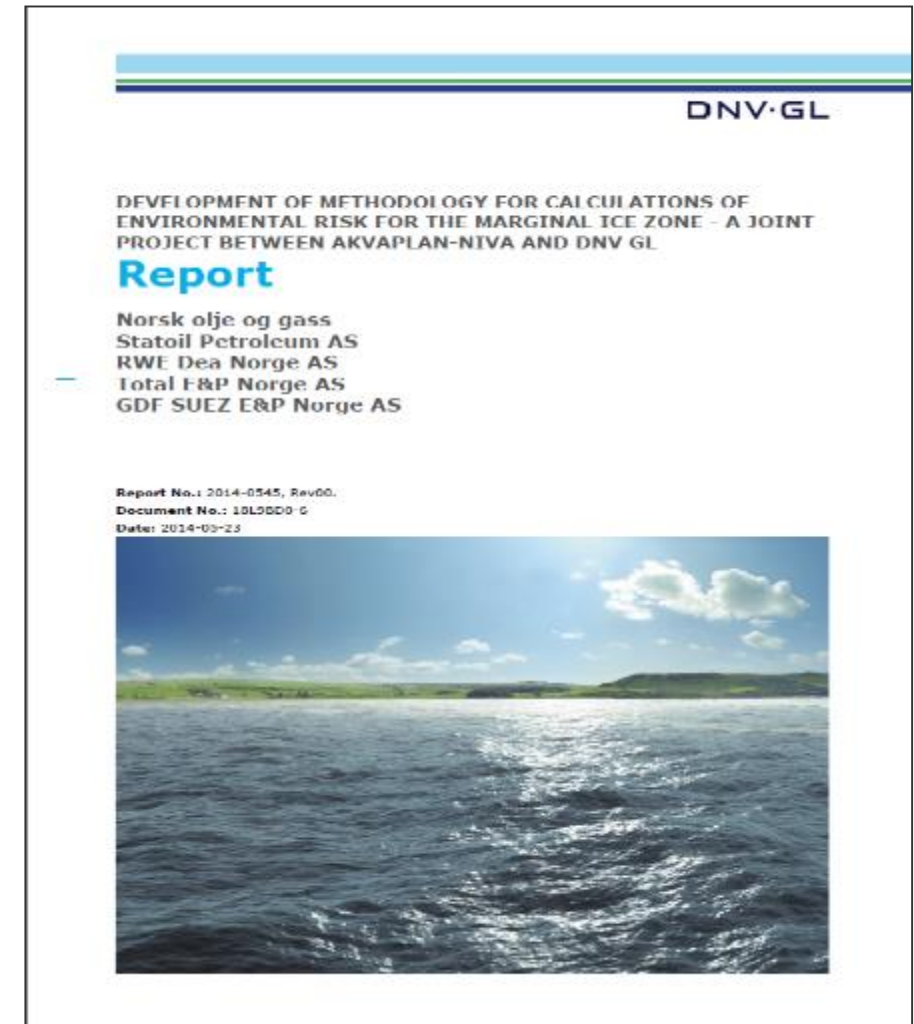
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DEVELOPMENT OF METHODOLOGY FOR CALCULATIONS OF ENVIRONMENTAL RISK FOR THE MARGINAL ICE ZONE

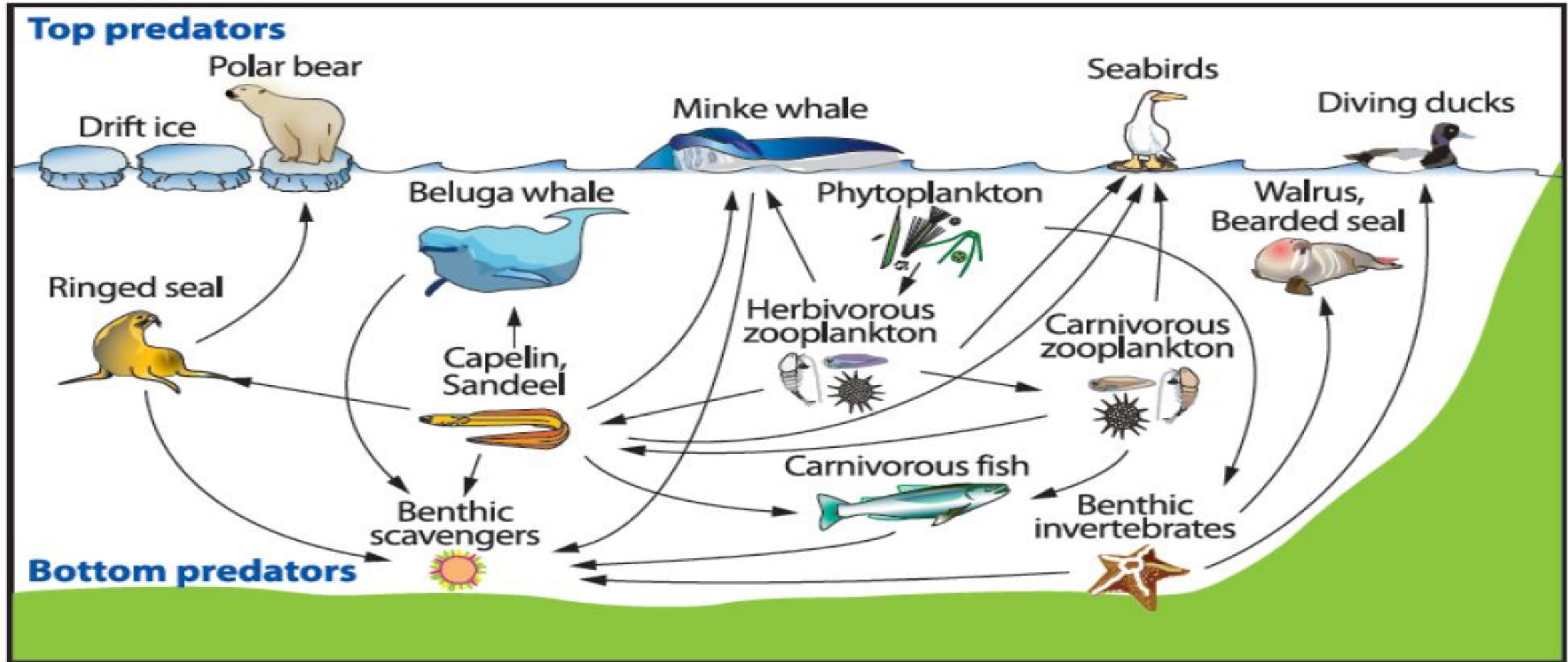
- The Norwegian Oil and Gas Association (NOROG) has identified the need for an agreed methodology for calculating environmental risk for the marginal ice zone (MIZ), also referred to as the ice-edge
- Operators; Statoil Petroleum AS, RWE Dea Norge AS, Total E&P Norge AS, GDF Suez E&P Norge AS
- Scope of Work for the project was to identify and develop an approach within the current MIRA method (OLF 2007) that can be applied already from this year
- We have arrived at a joint recommendation for phase one of performing environmental risk assessments for activities within the opened areas of the Norwegian Continental Shelf (NCS) where accidental discharges of oil may affect the MIZ



Delimitations

- The project covers areas of the MIZ in the Barents Sea that could be affected by oil spills from current oil and gas activities on the Norwegian Continental Shelf in the Barents Sea.
- Oil from an accidental release will have drifted on the sea surface for several days after the release before the oil reaches MIZ
- The proposed methodology does not cover spills of oil directly in or underneath ice or exposure scenarios resulting from oil that has been frozen into the ice.

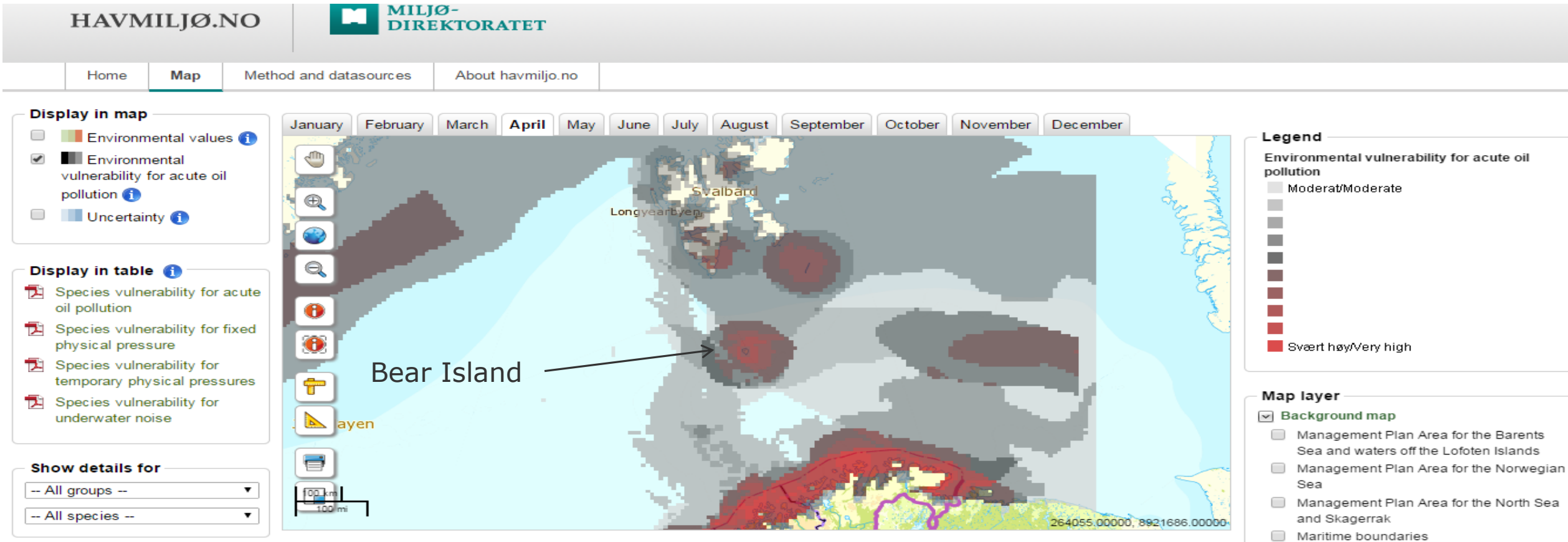
MIZ ecology – the Barents Sea



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Environmental vulnerability for acute oil pollution

- <http://havmiljo.no>



Vulnerability model - seabirds

Table 2. Factors used by Anker-Nilssen (1987) to describe the sensitivity of a seabird to oil pollution.

| Individual vulnerability | Population vulnerability |
|---------------------------------|---------------------------------------|
| 1 - Time in area | 10 - Degree of exposure |
| 2 - Time at sea | 11 - Population size |
| 3 - Area utilisation | 12 - Flocking tendency |
| 4 - Behaviour at sea | 13 - Frequency of immatures |
| 5 - Shore affinity | 14 - Reproductive potential |
| 6 - Possibility of reaction | 15 - Population trend |
| 7 - Flight capability | 16 - Proportion of population at risk |
| 8 - Physical fitness | 17 - Potential immigration |
| 9 - Recovery capability | |

- The vulnerability concept is divided into three categories
 - V1 low vulnerability
 - V2 moderate vulnerability
 - V3 high vulnerability

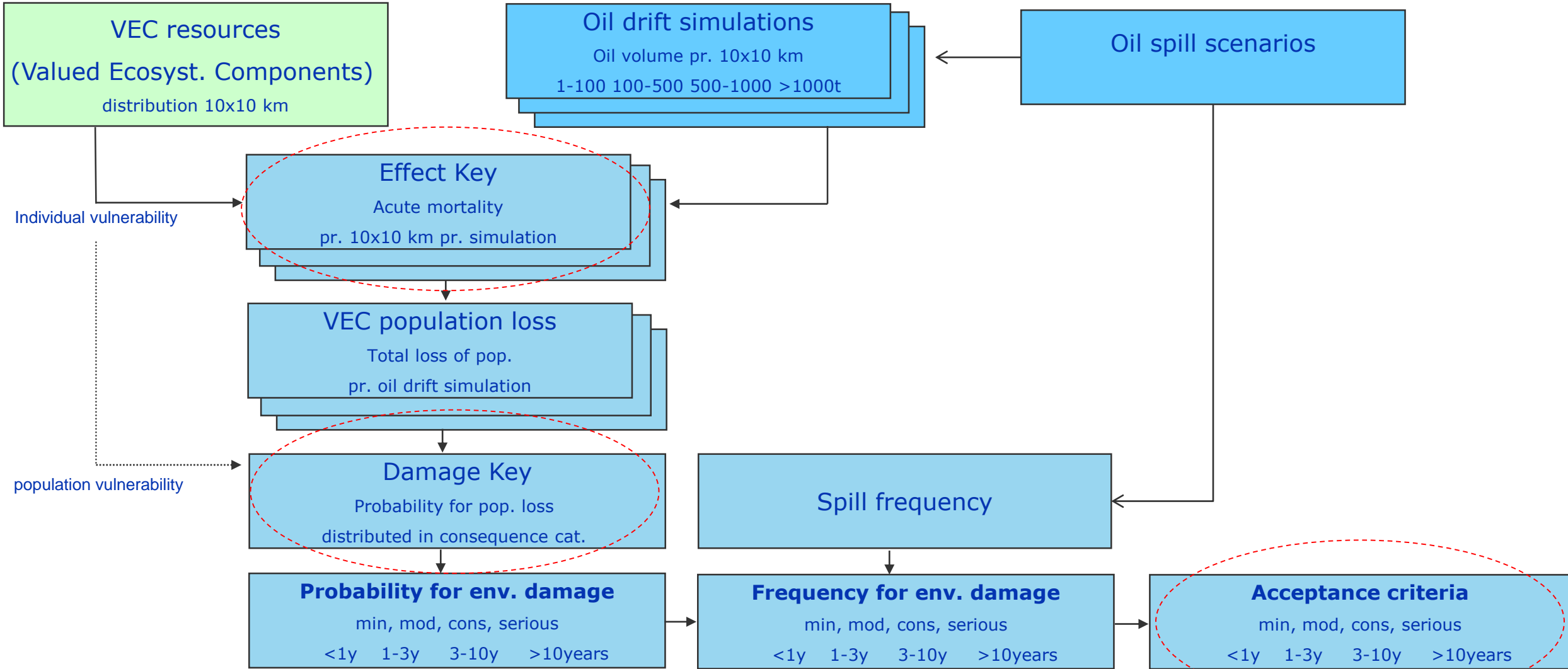
Source: Anker-Nilssen (1987)

Seabird aggregation – increases vulnerability

- ... nearly the entire global population of spectacled eiders (*Somateria fischeri*) wintered together in the northern Bering Sea...



Oil spill risk assessment (MIRA method)



Currently used monthly values in MIRA - Seabirds

- Seabirds cannot be treated as one uniform group
- Different species use the sea in different ways for foraging and rest
- All seabirds have a high probability of being exposed to oil emulsion on the surface, but different adaptations for feeding and rest imply that the risk of being exposed to oil varies between the species.

Table 1: Monthly vulnerability values for the most relevant seabird species.

| Species | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Okt | Nov | Des |
|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Razorbill | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Little auk | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Fulmar | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Barnacle goose | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 0 |
| Great northern diver | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Ivory gull | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| Black legged kittiwake | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Common guillemot | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Puffin | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Pomarine skua | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 |
| Brünnich's guillemot | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Glaucous gull | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Grey phalarope | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| King eider | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Arctic tern | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 1 | 0 | 0 | 0 |
| Sabine's gull | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Steller eider | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Great black-backed gull | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Black guillemot | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Greater White-fronted Goose | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |

Proposal: New individual vulnerability for seabirds in the MIZ

Table 8: The proposed new individual vulnerability for seabirds in the MIZ. Bjørnøya breeding birds are marked by colour green.

| English name | Scientific name | Jan | Feb | Mar | Apr | Mai | Jun | Jul | Aug | Sep | Oct | Nov | Des | Red list Svalbard | Red list Norway | IUCN |
|-----------------------------|-------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------------------|-----------------|-----------------|
| Razorbill | <i>Alca torda</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | EN | VU | Least Concern |
| Little auk | <i>Alle alle</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | Least Concern |
| Fulmar | <i>Fulmarus glacialis</i> | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | NT | Least Concern |
| Barnacle goose | <i>Branta leucopsis</i> | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 0 | | | Least Concern |
| Great northern diver | <i>Gavia immer</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | Least Concern |
| Ivory gull | <i>Pagophila eburnea</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | VU | Near Threatened |
| Black legged kittiwake | <i>Rissa tridactyla</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | NT | EN | Least Concern |
| Common guillemot | <i>Uria aalge</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | VU | CR | Least Concern |
| Puffin | <i>Fratercula arctica</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | VU | Least Concern |
| Pomarine skua | <i>Stercorarius pomarinus</i> | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | | | Least Concern |
| Brünnich's guillemot | <i>Uria lomvia</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | NT | VU | Least Concern |
| Glaucous gull | <i>Larus hyperboreus</i> | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | NT | | Least Concern |
| Grey phalarope | <i>Phalaropus fulicarius</i> | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | NT | | Least Concern |
| King eider | <i>Somateria spectabilis</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | NT | | Least Concern |
| Arctic tern | <i>Sterna paradisaea</i> | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | | | Least Concern |
| Sabine's gull | <i>Xema sabini</i> | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | EN | | Least Concern |
| Steller eider | <i>Polysticta stelleri</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | VU | Vulnerable |
| Great black-backed gull | <i>Larus marinus</i> | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | | Least Concern |
| Black guillemot | <i>Cephus grylle</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | VU | Least Concern |
| Greater White-fronted Goose | <i>Anser albifrons</i> | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | | | Least Concern |
| Common eider | <i>Somateria mollissima</i> | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | Least Concern |
| Pink-footed goose | <i>Anser brachyrhynchus</i> | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | | | Least Concern |
| Brent goose | <i>Branta bernicla</i> | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 0 | NT | | Least Concern |

CONCLUSIONS AND RECOMMENDATIONS - VULNERABILITY

▪ **Definition of the MIZ**

- Based on oil exposure scenarios and changes in species vulnerability resulting from the presence of ice we recommend to use 10-30 % ice concentration when performing ERAs for the MIZ. This is a moderately conservative selection from the different options for defining the MIZ.

▪ **Vulnerability, effect keys and damage keys**

- There are no major changes in the overall model structure, and to a large extent existing data can be applied with no or minor modifications. For quantitative assessments within the existing damage based MIRA, changes and modifications required are given below.

Example: Seabirds:

- Revised vulnerability values need to be applied

Thank you for you attention!

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