# A framework for assessing the state of ecosystems based on some principles from IPCC

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Integrating information at different scales
in the framework of EA implementation

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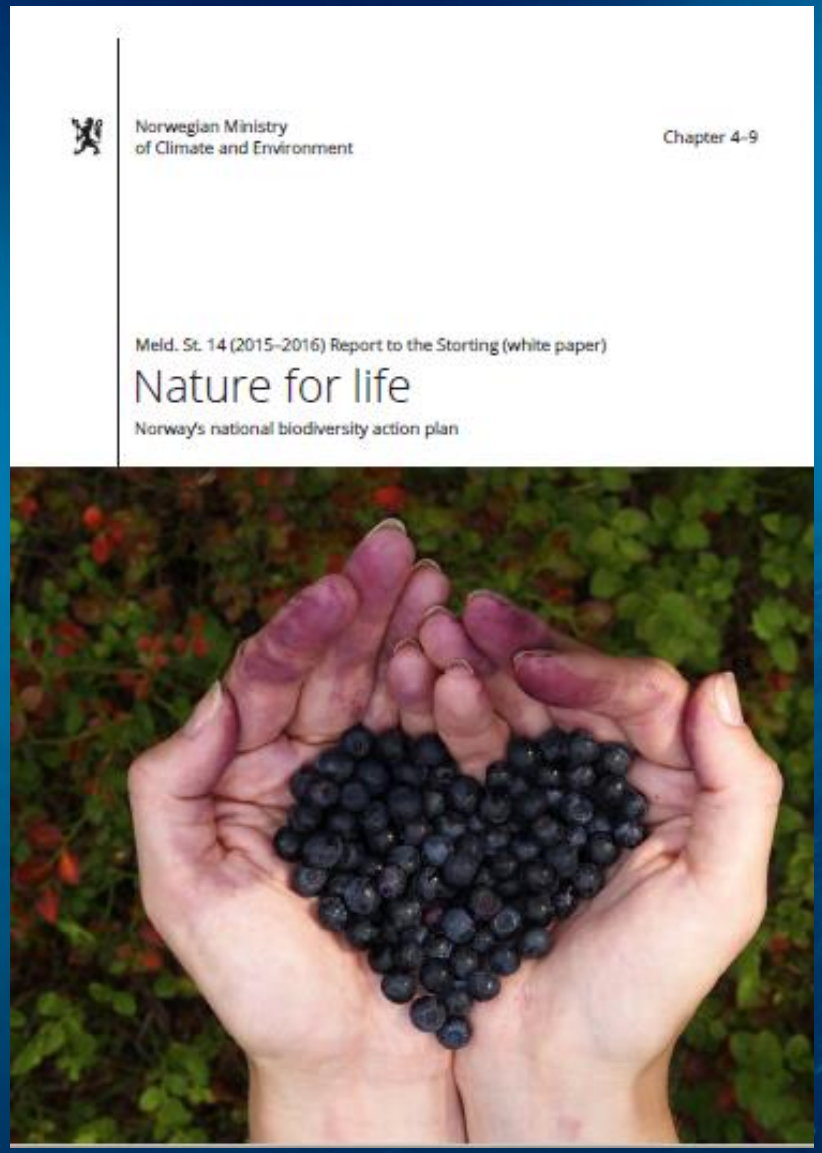
# Background

Develop a framework for assessing state of ecosystems in Norway

Shall reflect structure and function of ecosystems and take into account natural dynamics




2017

# State assessed for 7 ecosystem properties

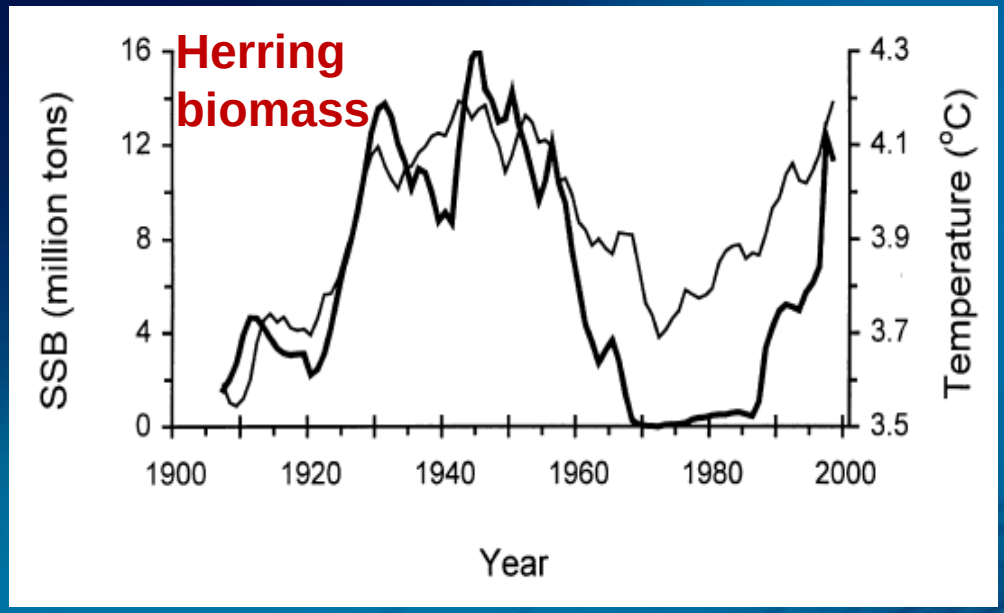
1. Primary productivity
2. Distribution of biomass among trophic levels
3. Diversity of functional groups
4. Abundance of functionally important species
5. Landscape patterns (size of habitats etc)
6. Species and genetic diversity
7. Abiotic factors

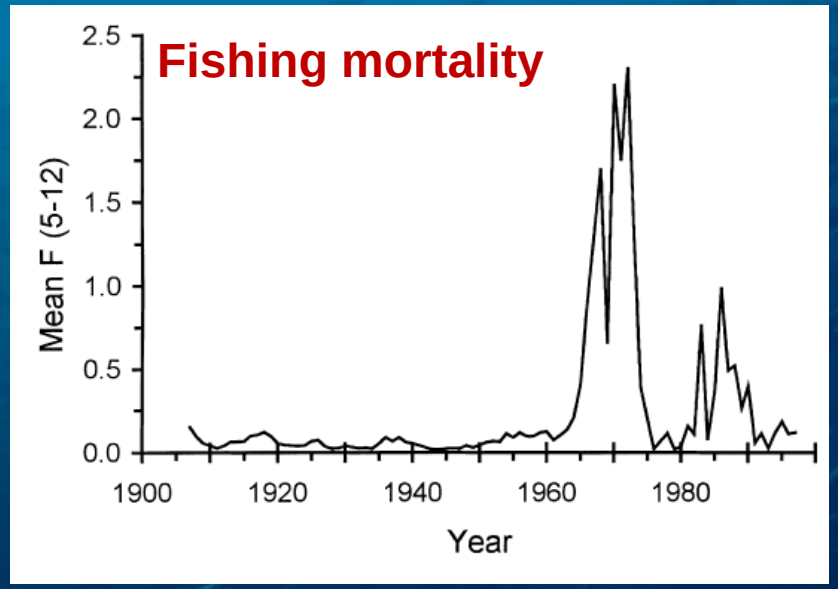
Assessed against a background of minimal human impact

A set of indicators developed for each property

# The way not to go

- Estimate reference values for each indicator
- Estimate treshold values for poor ecological state for each indicator




Toresen, R. & Østvedt, O.J. 2000. Variation in abundance of Norwegian spring-spawning herring (Clupea harengus, Clupeidae) throughout the 20th century and the influence of climatic fluctuations. Fish and Fisheries 1(3): 231-256

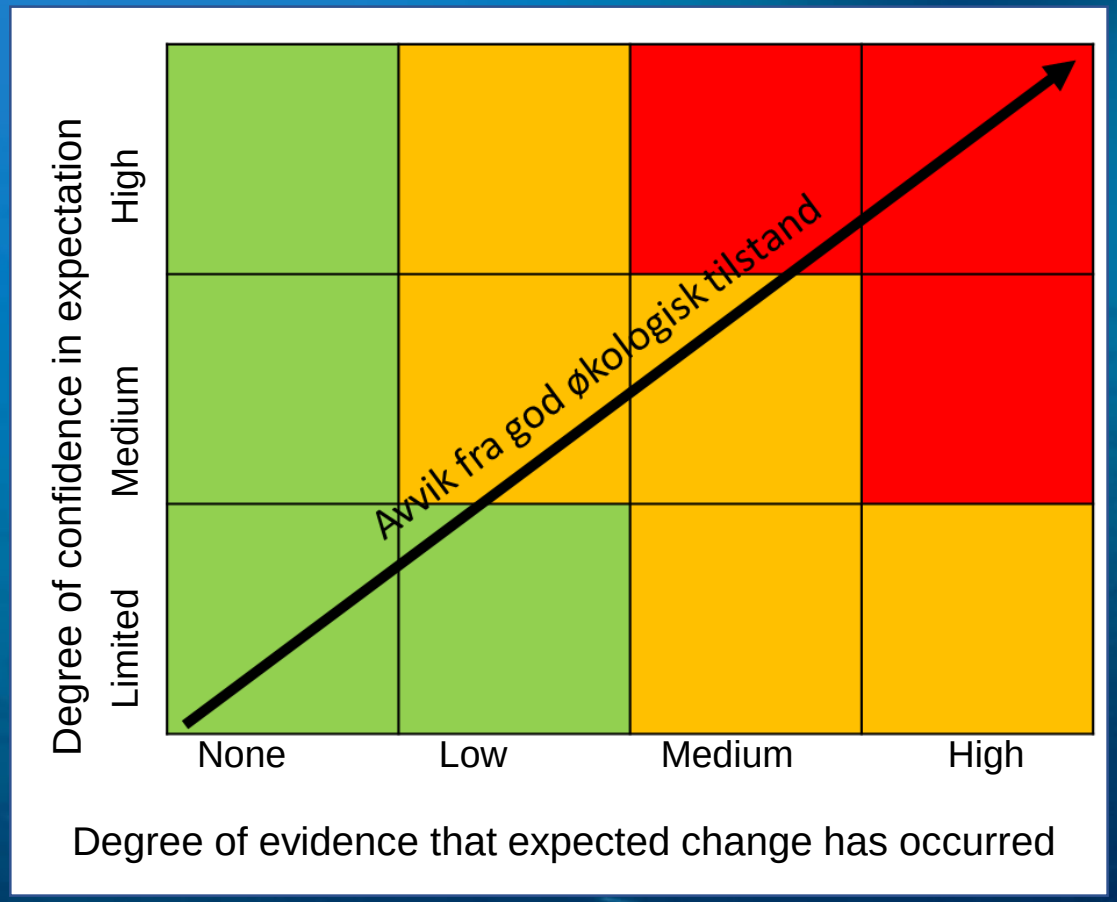
# A way to go

- Describe how we expect each indicator to change under influence of important drivers in the system
- We term such a description a *phenomenon*
- An example: Increase in total primary production in the northern part of the Barents Sea
- The phenomena should be justified based in scientific literature.
- Then assess how confident we are in each phenomenon
- Through statistical analyses of indicator time series, assess for each phenomenon whether it has occurred, and if so to which extent.

# Assessment of phenomena (expected changes)

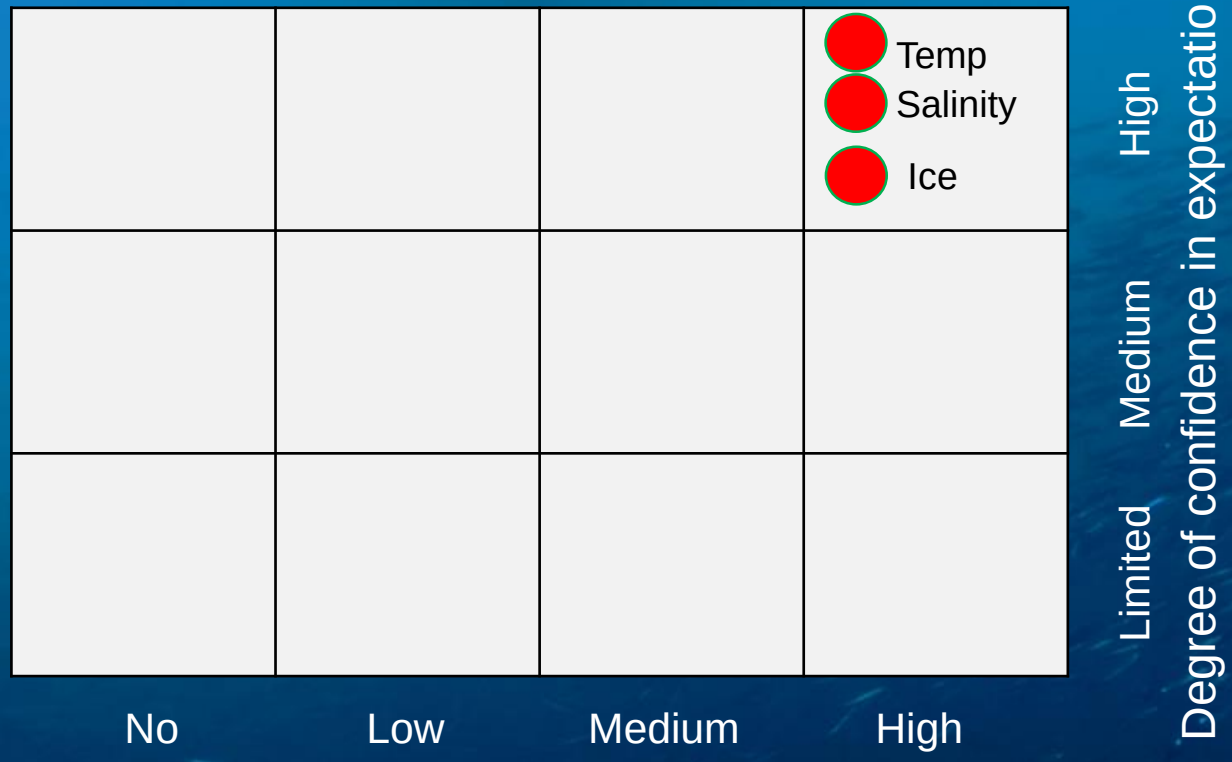
| | | | | |
|---|---|---|---|---|
| **Evidence of occurrence of expected change** | **High** | **Medium** | **Low** | **None** |
| **Assessment of confidence in expectation** | **Good** | **Medium** | | **Limited** |

# Overall assessment of state for each ecosystem property

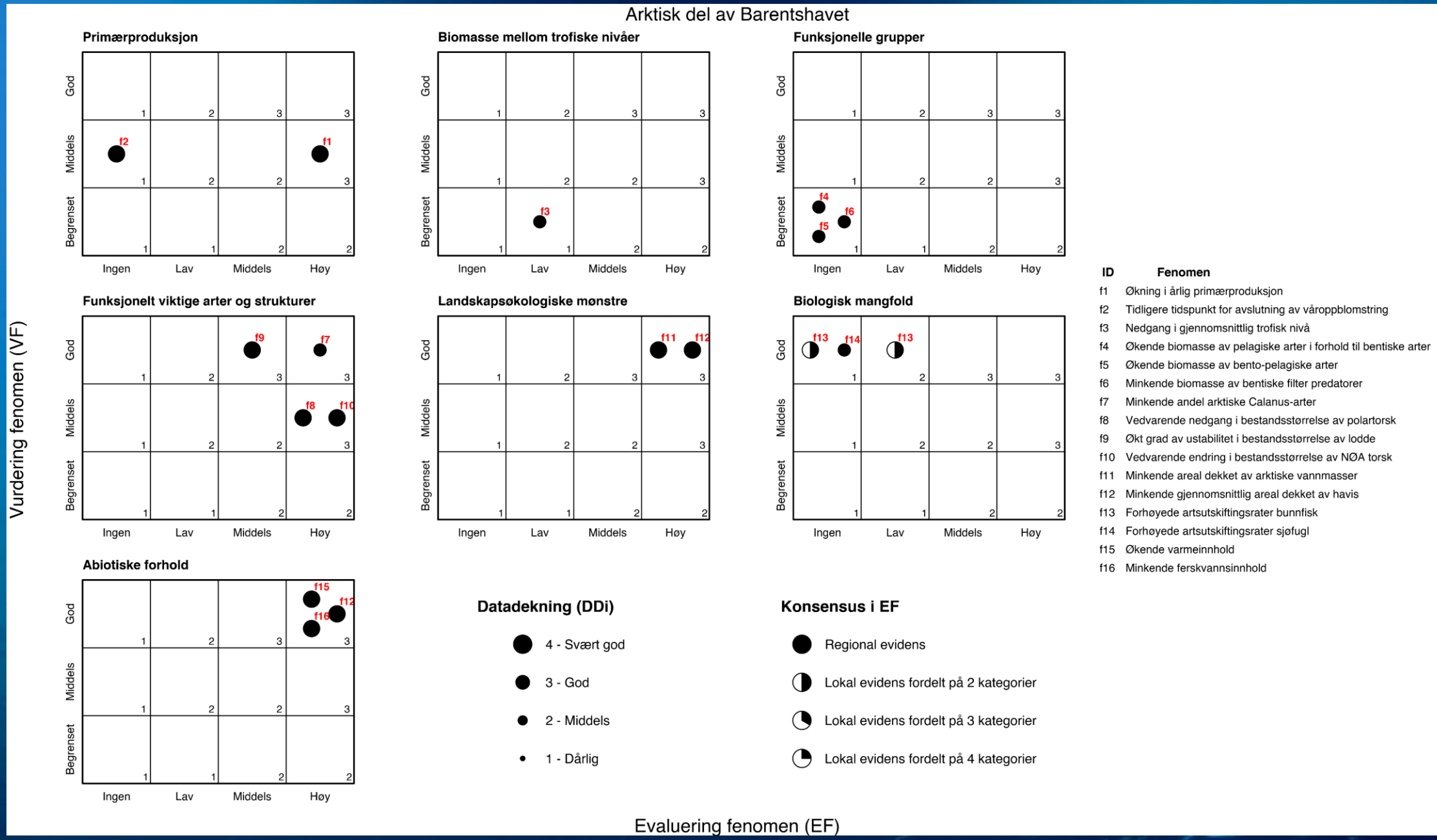



- No deviations from good ecological state
- Limited deviations from good ecological state
- Considerable deviations from good ecological state
- Criteria + ecological intelligence

# Example for “abiotic factors”
# Arctic part of the Barents Sea



# All ecosystem properties, Arctic part of the Barents Sea




| ID | Fenomen |
|---|---|
| f1 | Økning i årlig primærproduksjon |
| f2 | Tidligere tidspunkt for avslutning av våroppblomstring |
| f3 | Nedgang i gjennomsnittlig trofisk nivå |
| f4 | Økende biomasse av pelagiske arter i forhold til bentiske arter |
| f5 | Økende biomasse av bento-pelagiske arter |
| f6 | Minkende biomasse av bentiske filter predatorer |
| f7 | Minkende andel arktiske Calanus-arter |
| f8 | Vedvarende nedgang i bestandsstørrelse av polartorsk |
| f9 | Økt grad av ustabilitet i bestandsstørrelse av lodde |
| f10 | Vedvarende endring i bestandsstørrelse av NØA torsk |
| f11 | Minkende areal dekket av arktiske vannmasser |
| f12 | Minkende gjennomsnittlig areal dekket av havis |
| f13 | Forhøyede artsutskiftingsrater bunnfisk |
| f14 | Forhøyede artsutskiftingsrater sjøfugl |
| f15 | Økende varmeinnhold |
| f16 | Minkende ferskvannsinnhold |

# Assessment of the whole ecosystem

| Ecosystem property | Overall assessment | Indicator coverage |
|---|---|---|
| Primary productivity | Considerable deviations | Medium |
| Biomass trophic levels | No deviation | Limited |
| Functional groups | No deviation | Limited |
| Functionally important species | Considerable deviations | Medium |
| Landscape patterns | Considerable deviations | Medium |
| Species and genetic diversity | No deviation | Limited |
| Abiotic factors | Considerable deviations | Good |

Based on the assessment of the entire ecosystem, **it is concluded that the state of the ecosystem in the Arctic part of the Barents Sea is not good**. The most important change is that the climate, which is a part of the ecosystem, has warmed substantially, and that this is at least partly a result of greenhouse gas emissions greenhouse and other anthropogenic impact on the climate. The rest of the ecosystem exhibit changes that can be related to the climate warming, especially for the ecosystem properties with good indicator coverage.