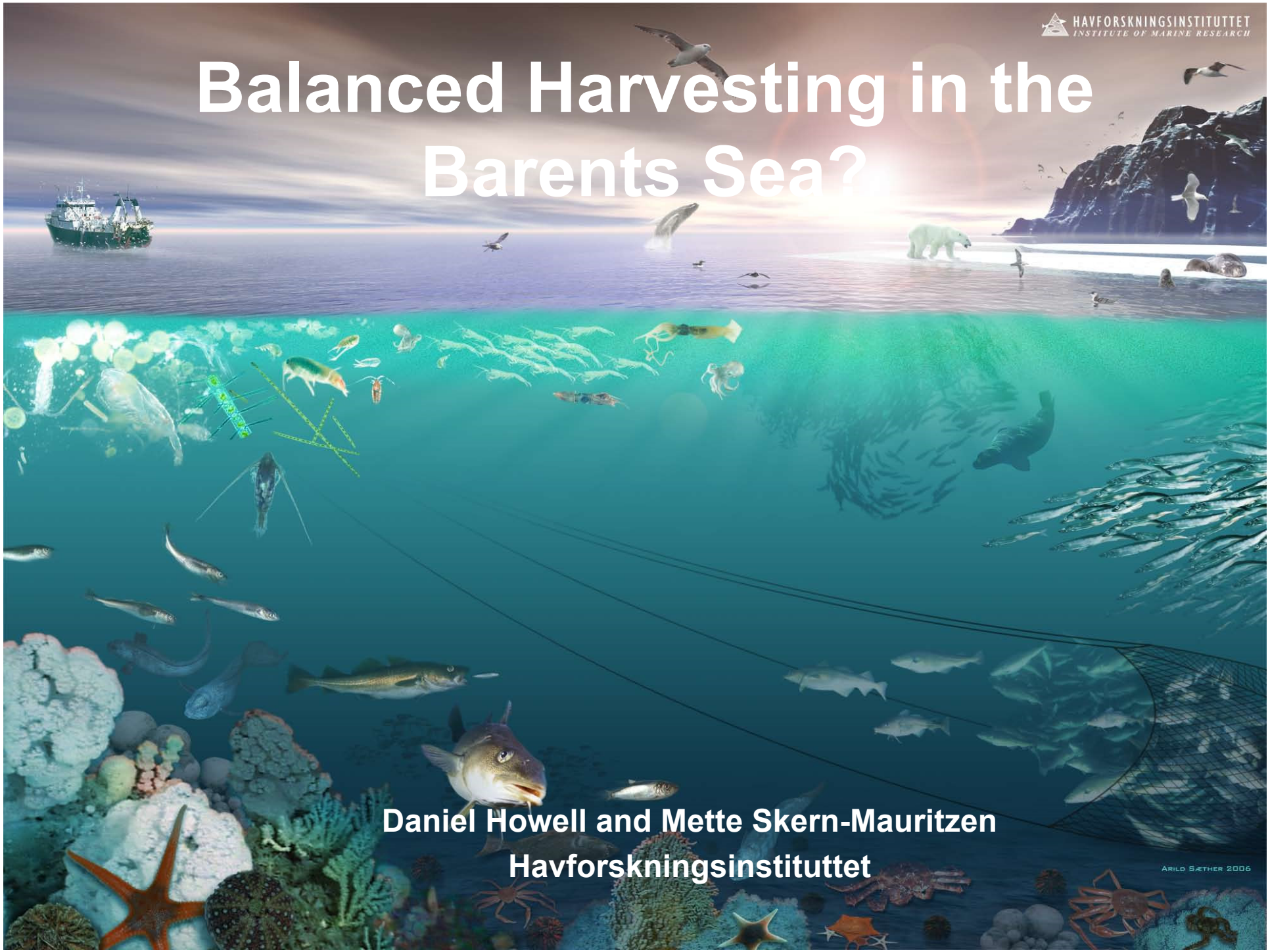
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Balanced Harvesting in the Barents Sea?
Daniel Howell and Mette Skern-Mauritzen
Havforskningsinstituttet
ARILD SÆTHER 2006

Balanced fishing: the solution to our problems?

In many regions, fisheries management is perceived to be ”broken” and needing a new approach

History of overfishing and stock collapse

Increasing desire to manage the whole ecosystem

At the same time there is an understanding that as world population grows there will be pressure to extract more protein from the seas.

Balanced harvesting is a ”hot topic” at the moment,

Because it promises to address all of these

Science, 2012:

POLICYFORUM

CONSERVATION

Reconsidering the Consequences of Selective Fisheries

Balanced fishing across a range of species, stocks, and sizes could mitigate adverse effects and address food security better than increased selectivity.

S. M. Garcia,[1*] J. Kolding,[1,2*] J. Rice,[1,3*] M.-J. Rochet,[4*†] S. Zhou,[5*] T. Arimoto,[6] J. E. Beyer,[7] L. Borges,[8] A. Bundy,[9] D. Dunn,[10] E. A. Fulton,[11] M. Hall,[12] M. Heino,[2,13,14] R. Law,[15] M. Makino,[1,16] A. D. Rijnsdorp,[17] F. Simard,[18] A. D. M. Smith[11]

Balanced harvesting … distributes a moderate mortality from fishing across the widest possible range of species, stocks, and sizes in an ecosystem.

IUCN – FAO workshop Roma October 2014

”Traditional” harvesting

Target the most valuable species

- Often the largest (e.g. cod, haddock, saithe)
- Avoid catching the smallest individuals

Advantages

- Gives high profits for low effort/costs
- Gives high ”yield per recruit” of target species

Disadvantages

- Doesn’t give high yield in tonnes
- Wastefull if discarding is allowed
- Prone to stock collapse under high fishing pressure
- Can change the whole ecosystem structure by removing large fish

”Balanced” harvesting

Take a small catch of everything

- Catch in relation to ”productivity”
- Catching more small fish and fewer large ones

Advantages

- Gives high yield in tonnes
- Gives low disruption to ecosystem
- More resilient to higher fishing pressures

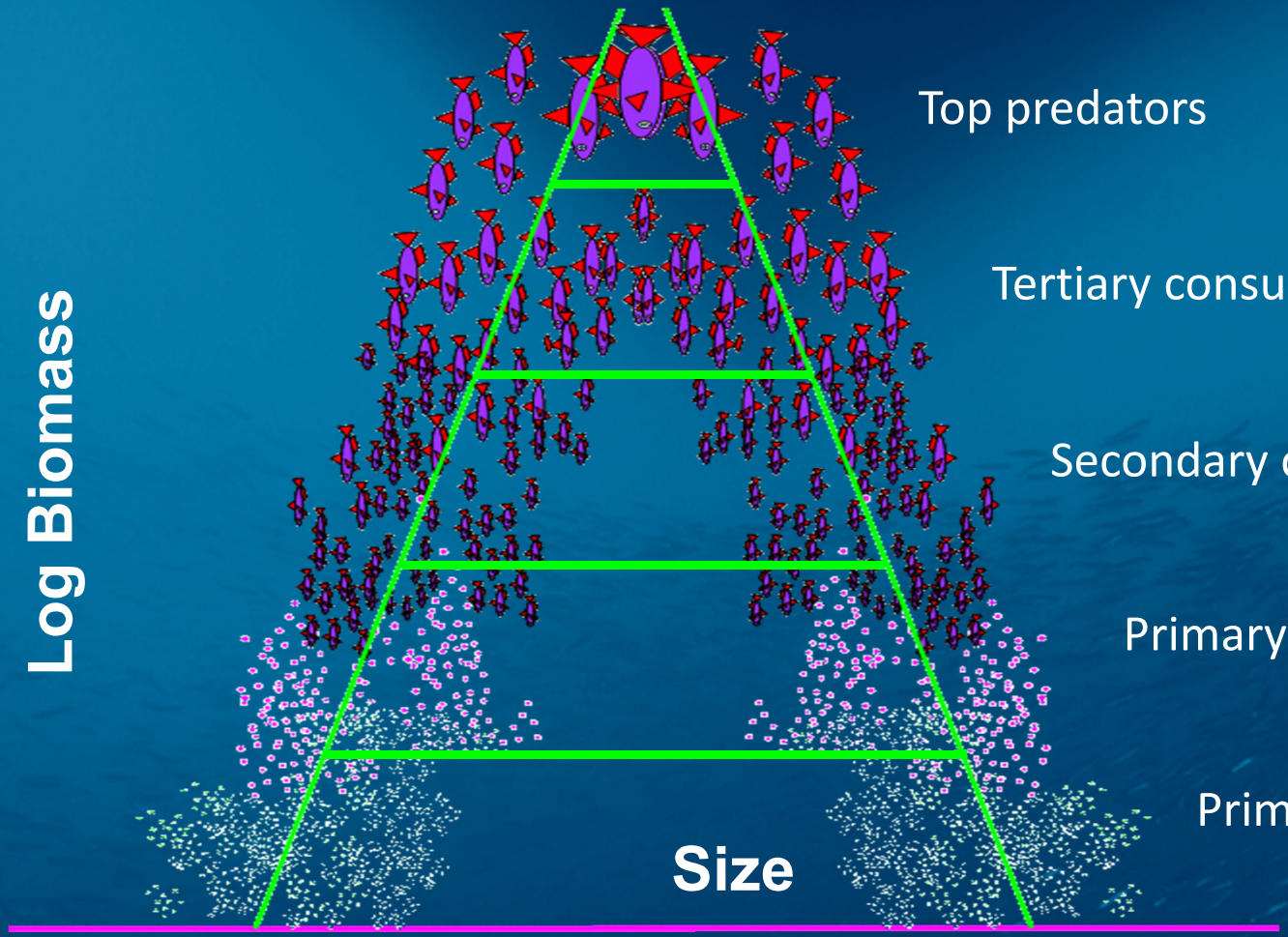
Disadvantages

- Doesn’t necessarily give high yield in value
- Not all sizes/species are commercially viable
- Could mean higher effort and fishing costs
- So far only validated in simple models and small ecosystems
- No proposed management scheme

Open question

- How would it work in real oceanic fisheries?

The aquatic food web is size structured…

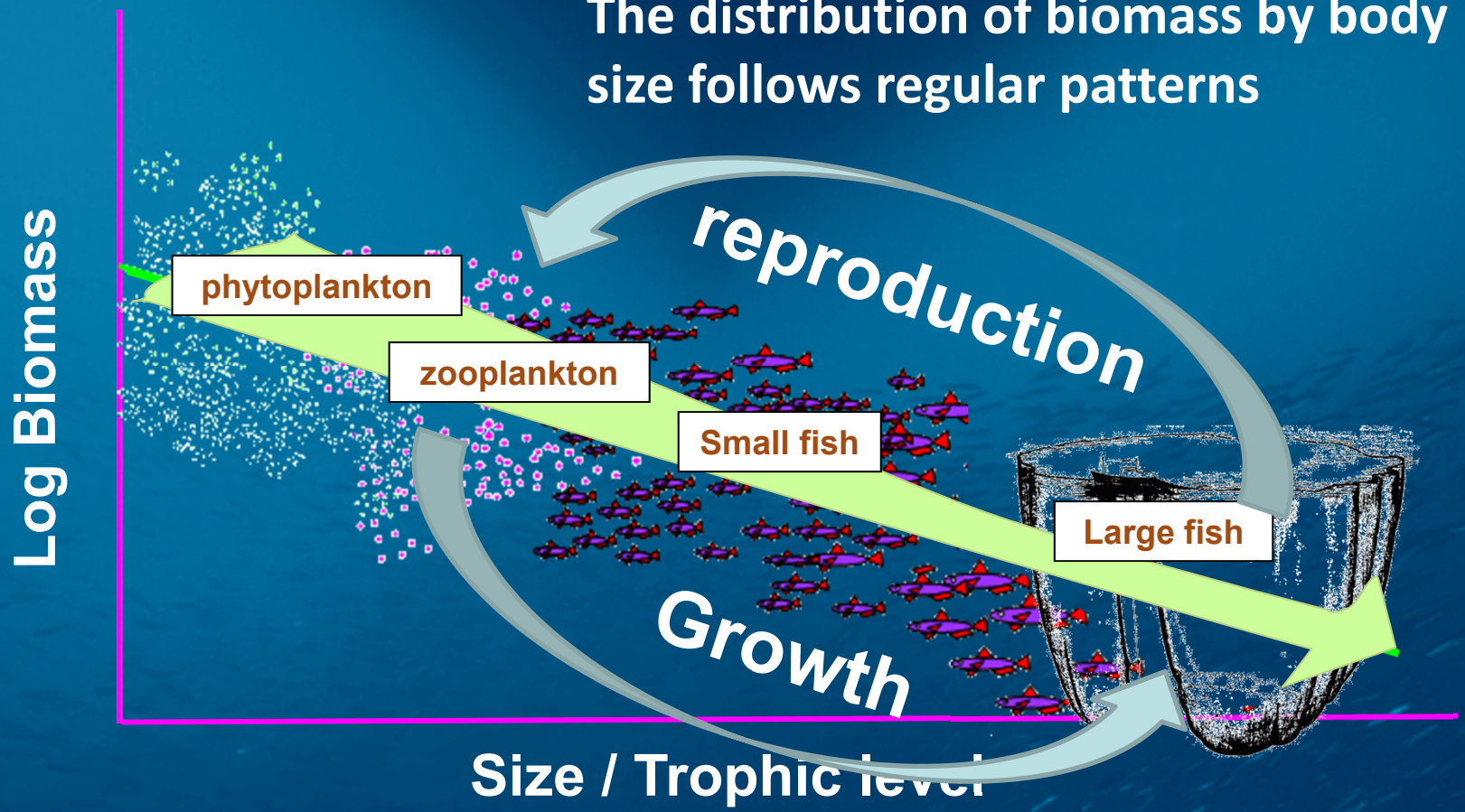


Abundance and production is inversely correlated with size

Curtesy Jeppe Kolding

Aquatic systems are size-structured

The distribution of biomass by body size follows regular patterns

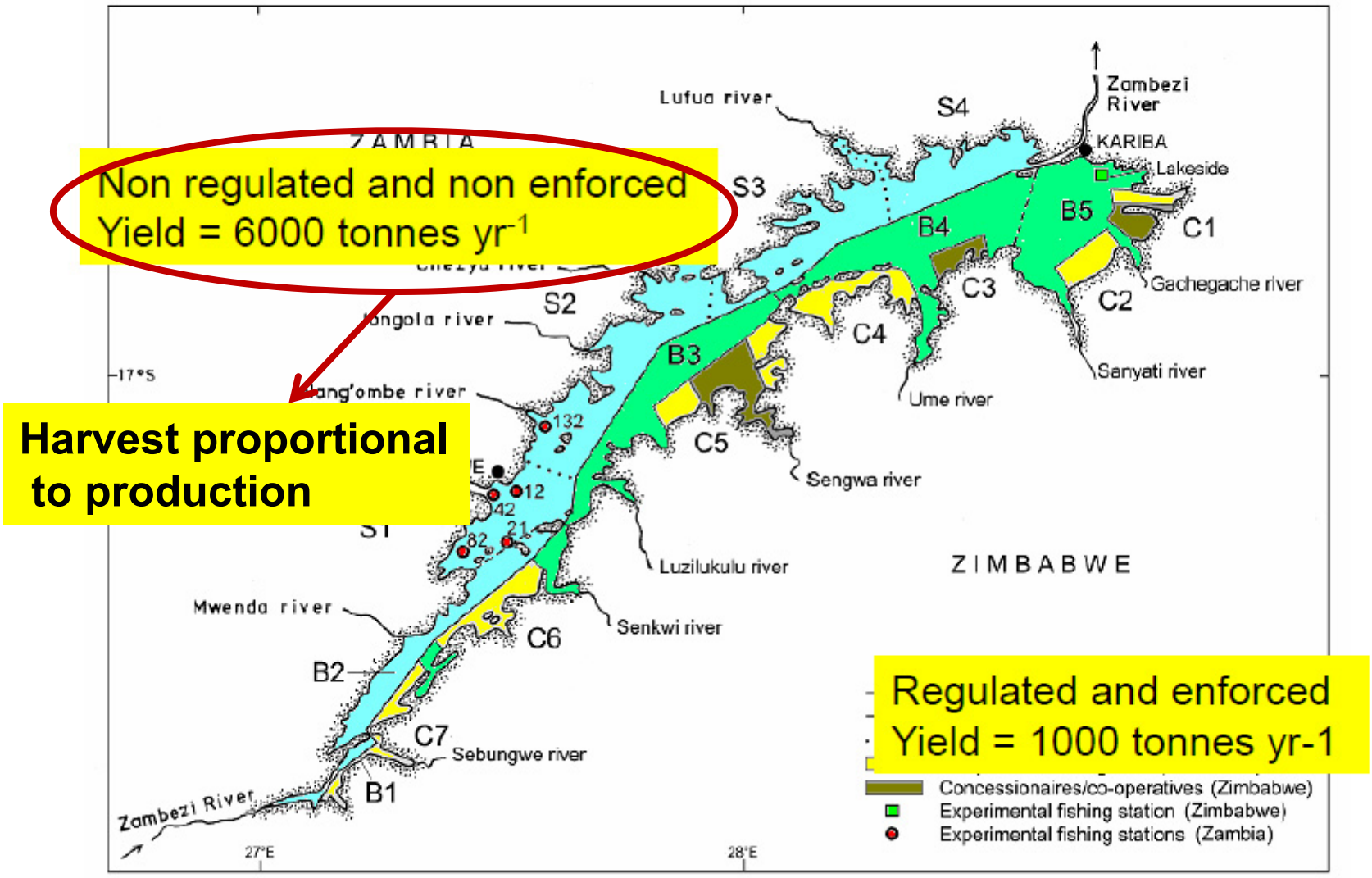


Under conventional selective fishing slope and intercept will change

Curtesy Jeppe Kolding

Lake Kariba

Jeppe Kolding m fl

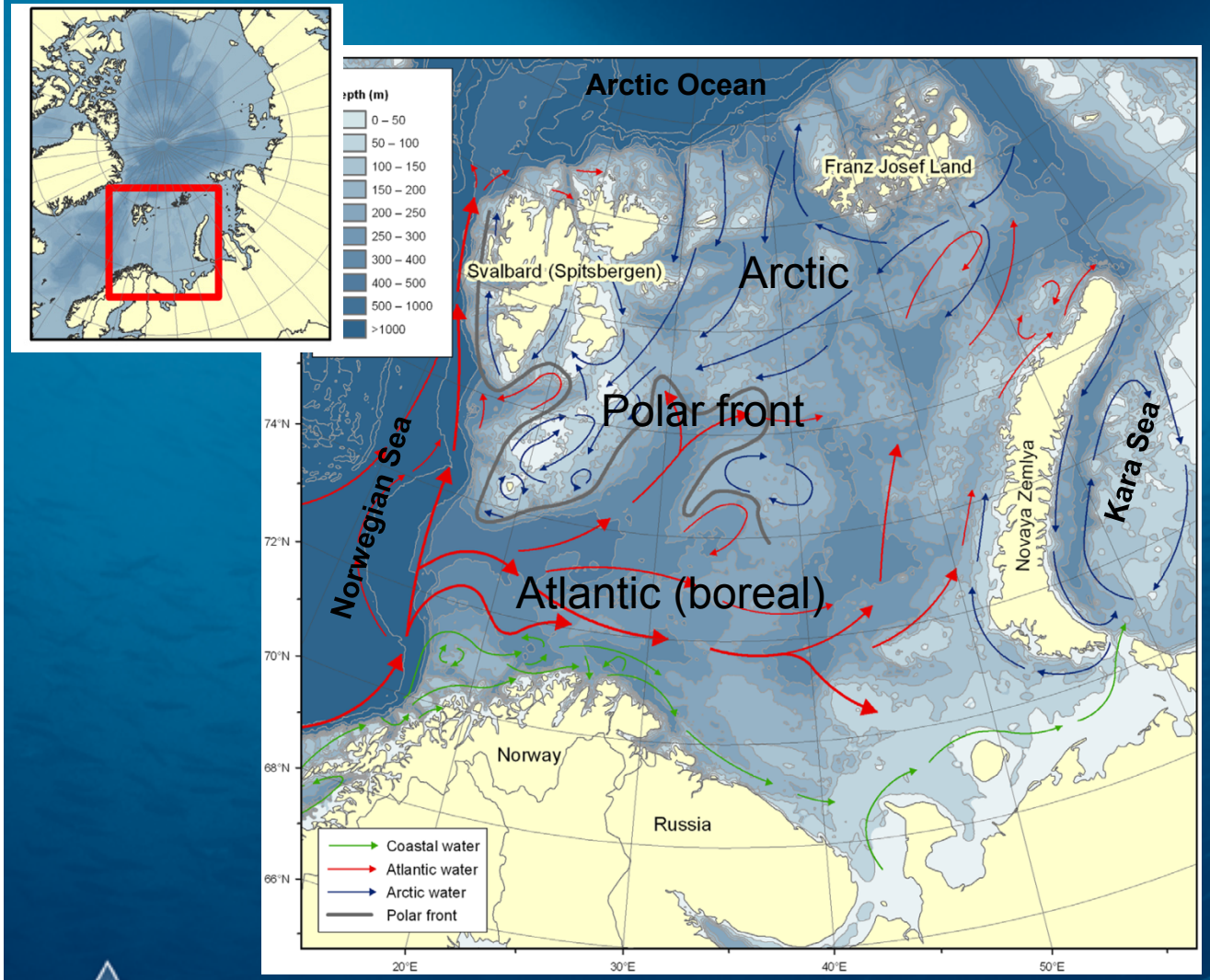


223 km long, 40 km wide

Barents Sea

- Step back from the generalities and look at the Barents Sea

Barents Sea ecosystem



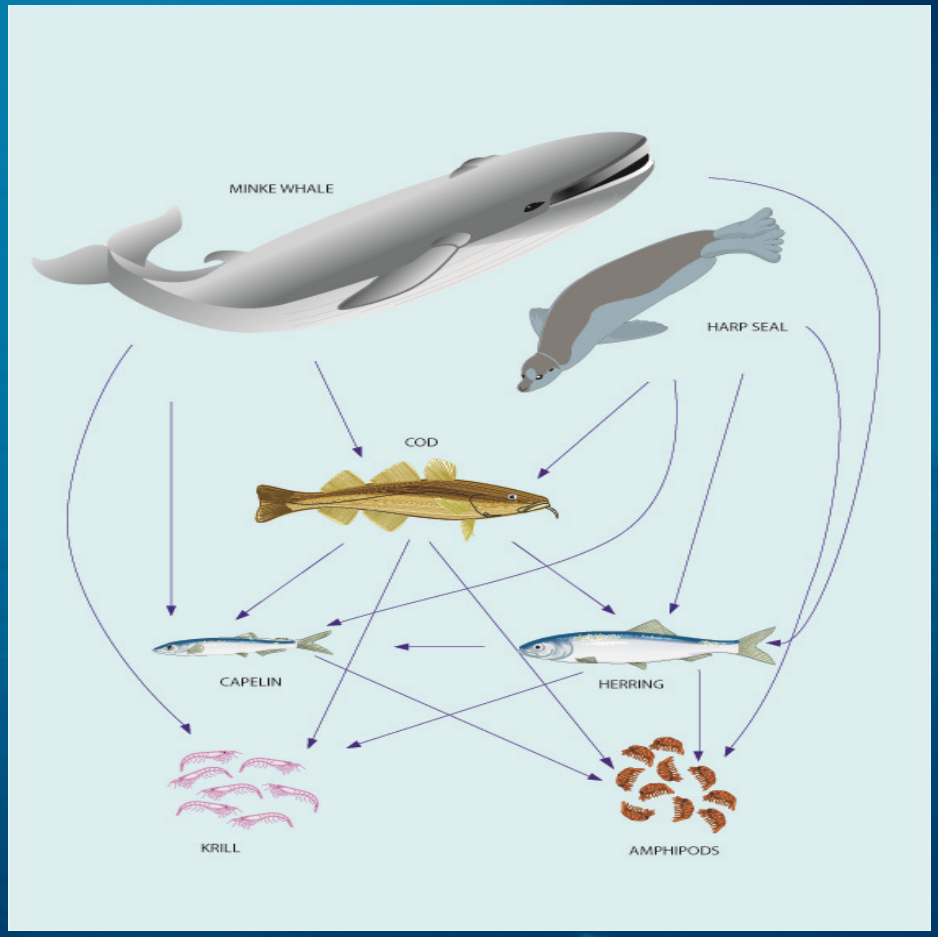
Covers 1.6 million km^2

➢Large, high latitude shelf sea

- Rich zooplankton community
- > 3000 benthic species
- > 200 fish species
- 21 species of marine mammals
- 33 species of seabirds (20 mill)

Strong hydrographic gradients
Ongoing warming – **no steady state to preserve**

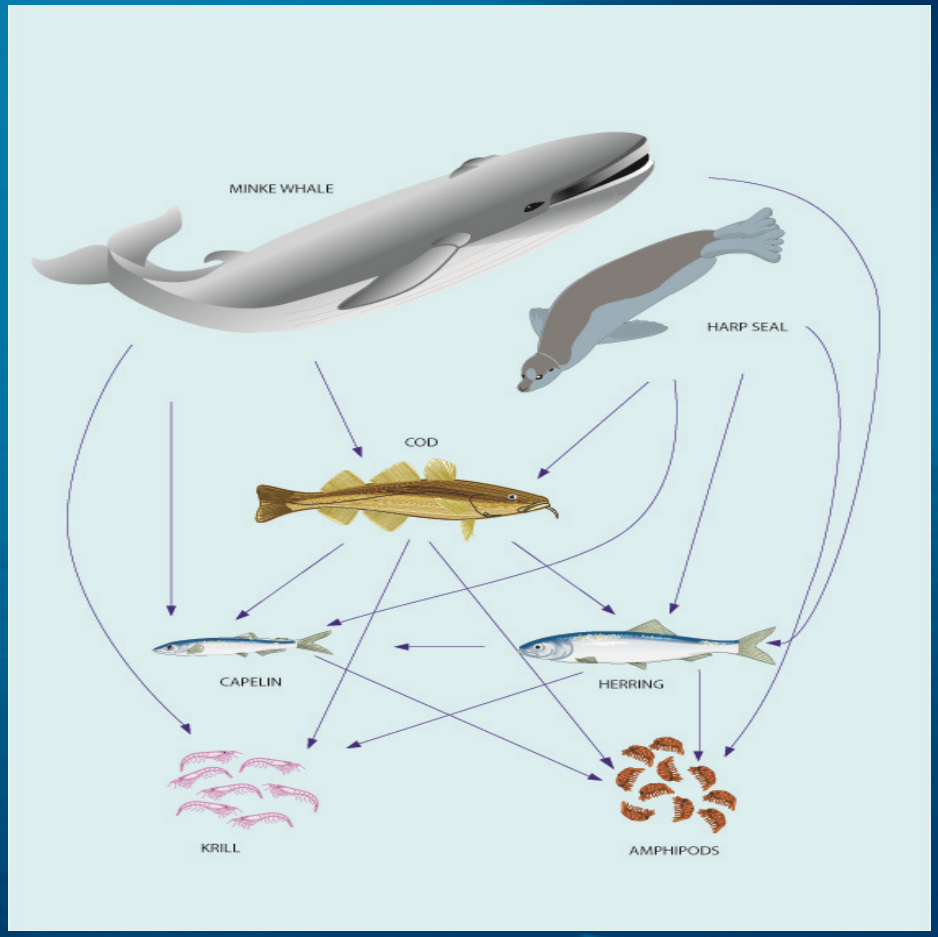
Fisheries and management in the Barents Sea



Current status:
- Large biomasses of pelagic fish
- Large biomasses of demersal fish
- Cod age and size structure soon comparable to population structure in the 40s
- Large total catches

BUT: some stocks still suffer from past overfishing
- e.g. redfish (S. norvegicus)

Fisheries and management in the Barents Sea



In the Barents Sea:

Traditional fisheries management and targeted, selective fisheries
- Performs well
- Highly profitable, no subsidies
- No significant (over)removal of large individuals

Johannesen et al. 2012. Changes in Barents Sea ecosystem state, 1970–2009: climate fluctuations, human impact, and trophic interactions. ICES J Mar Sci
Kjesbu et al. 2014. Synergies between climate and management for Atlantic cod fisheries at high latitudes. Fish and Fisheries
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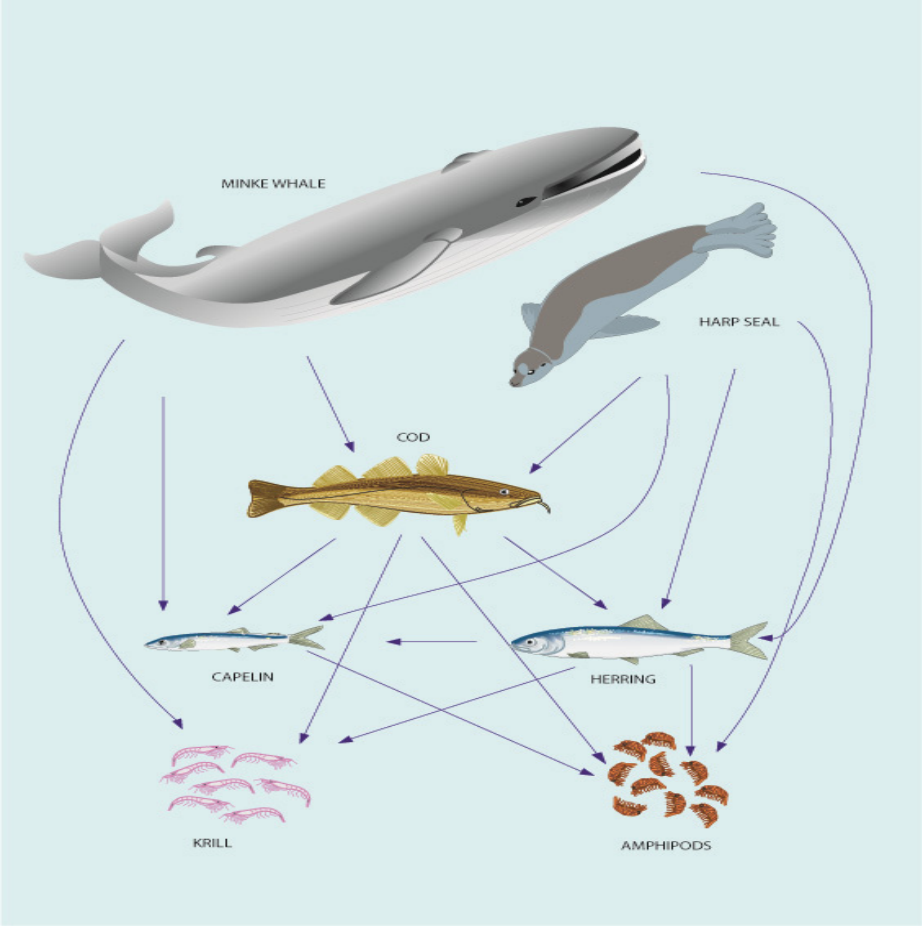
Fisheries and management



Why?
- Good stock monitoring systems
- Quantitative assessments
- HCRs implemented and enforced (little IUU fisheries)
- Simple management system; 2 nations
- Discard ban
- Limited mixed fisheries, TAC works
- Favourable climate regime: high productivity

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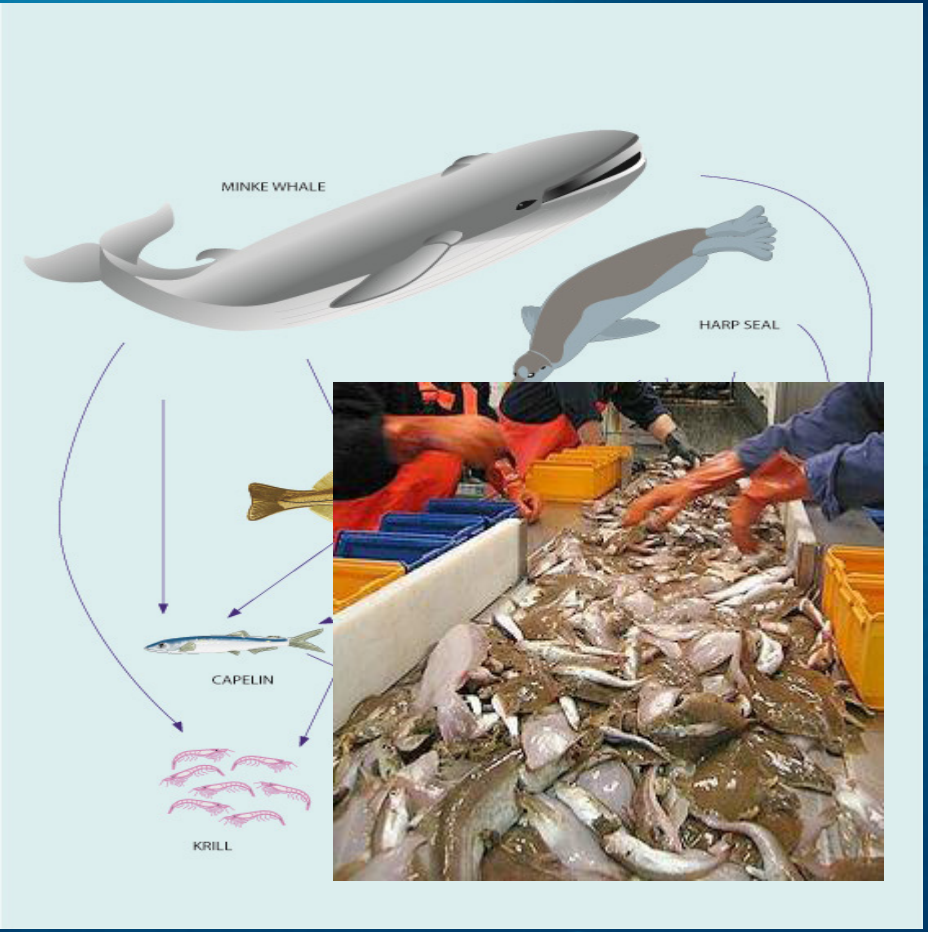

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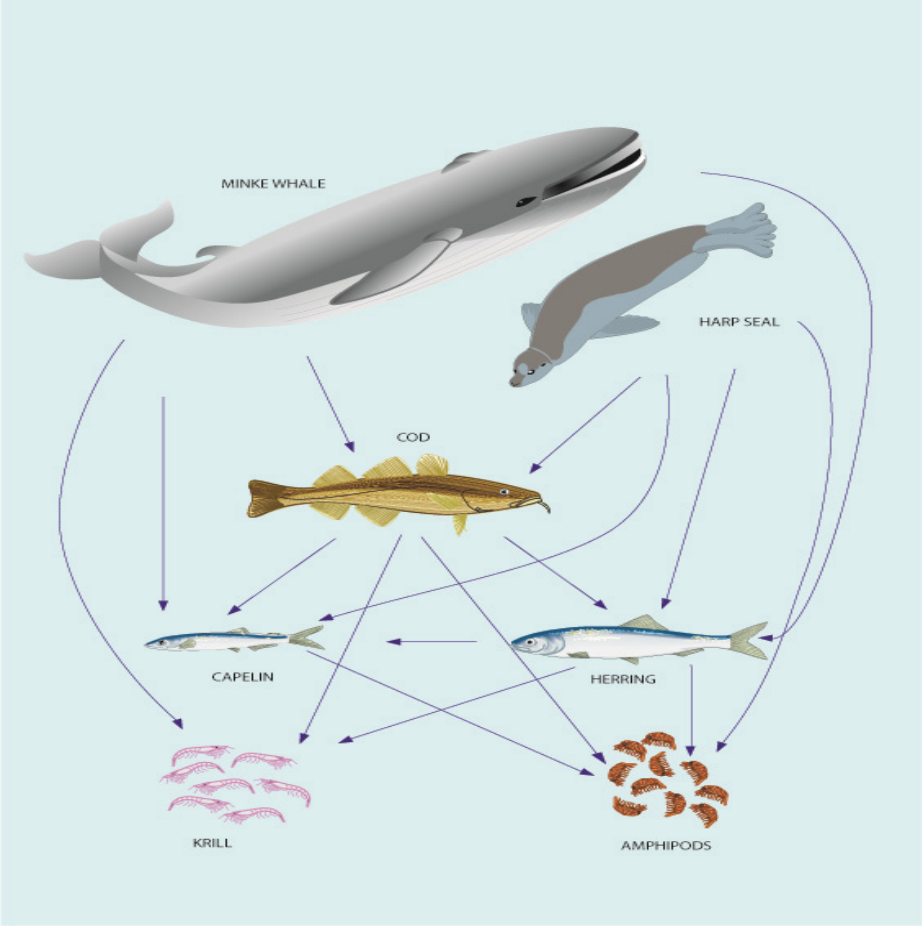
Fisheries and management



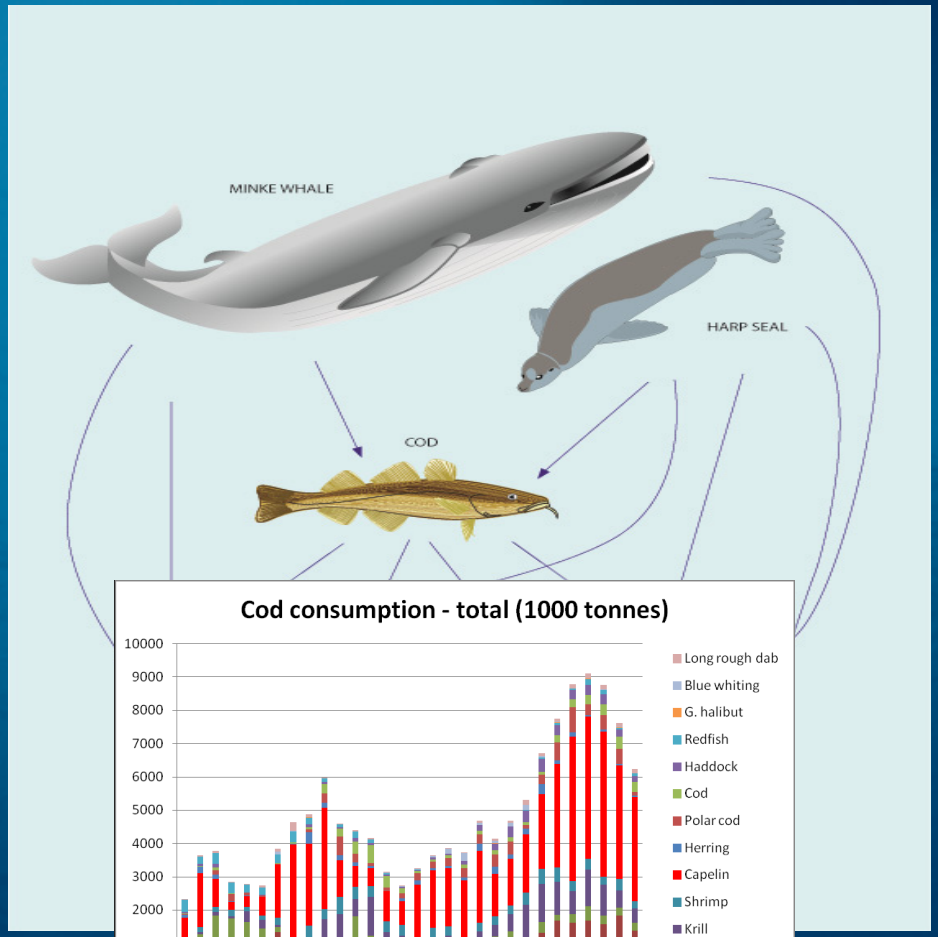
Harvest at multiple trophic levels:

- Zooplankton – copepods
- Shrimps and crabs
- Small pelagic fish
- Large demersal fish
- Marine mammals

Strong interspecific interactions

Some limited multipsecies considerations in current management

How to balance between stocks?



Cod consumption implemented in assessments and advice of

- Capelin (currently ~4 mill. tons)
- Haddock
- Young cod

Current strategy:

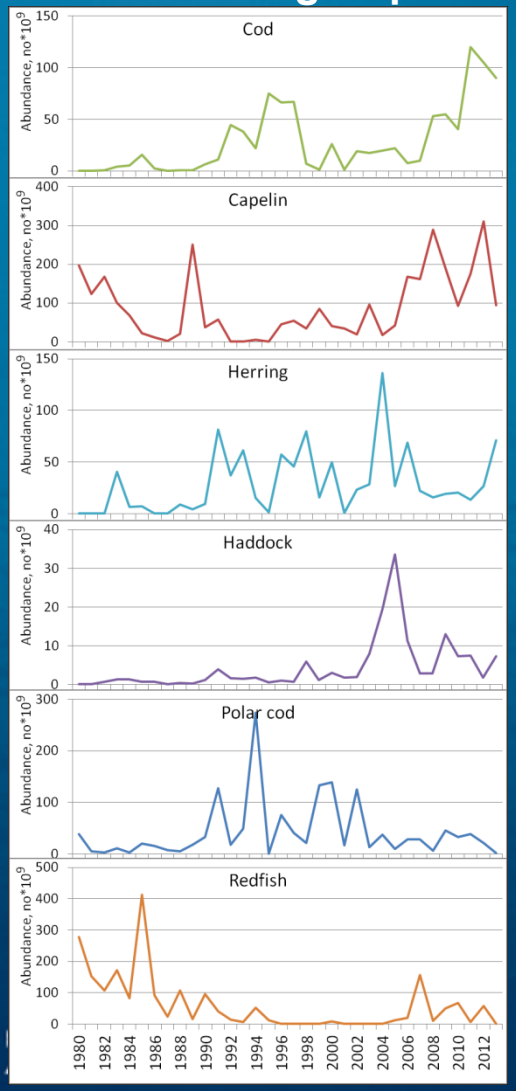
- Maximize catch of cod
- Catch capelin as a “residual” after cod consumption
- Catch of capelin - ~65 000 tons in 2014, < 10 % of the cod consumption

NOT balanced, but is highly profitable

Are we prepared to reduce profits for the sake of ”balance”?

Variable stock productivity

Abundance 0-group fish



Variable biology => variable productivity
Most of the modelling studies do not include this, but set a fixed F based on mean productivity

-For example:

For capelin - fixed F (from fixed productivity) results in

- overfishing at critically low abundances
- loss of catches when abundances are high

- Lower yield for cod and herring in Gadget model due to harvest on smaller individuals

Balanced over what?

Within a model, ”balancing” over size is easy to achieve

also in a closed system such as a lake which can be 100% covered by fishers and gear

In the real ocean it is more complex

all fishing is selective

Balanced *within* a species

catch more small cod and less large ones

Balance *between* species

catch more capelin and less cod

Balanced *within* a species

Would require setting some kind of quota by size category for each species

so many small cod, so many medium cod,…

Highly problematic

Scientific lack – we have poor data on how many recruiting fish on which to set such a quota

Burdensome for fishers – much more regulation than the current quota + minimum size

Not clear that this could be achieved

Balanced *between* species

This would fit within our management stucture

We already set quotas for many species

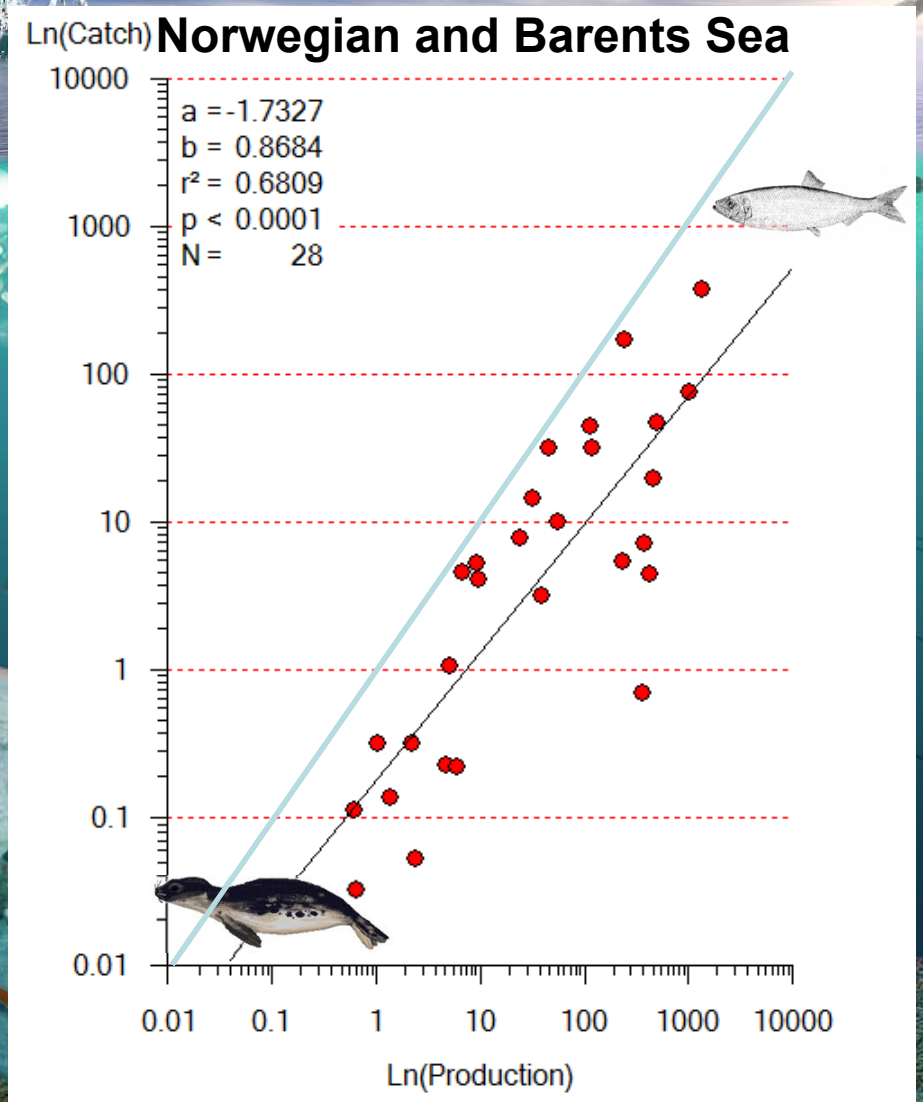
Just need to ”balance” the quotas, and introduce new ones for additional species

How much disruption would this cause?

Errr, almost none at all.

Because we already do something close to this.

Balanced harvest in the Barents Sea?



The most balanced harvest of ~200 marine ecosystems

BUT: not balanced across all species and size groups

BUT: Good enough?

'The Norwegian approach'

Curtesy Jeppe Kolding and Alida Bundy
Numbers from ECOPATH model (1997-2001)
Skaret and Pitcher in press

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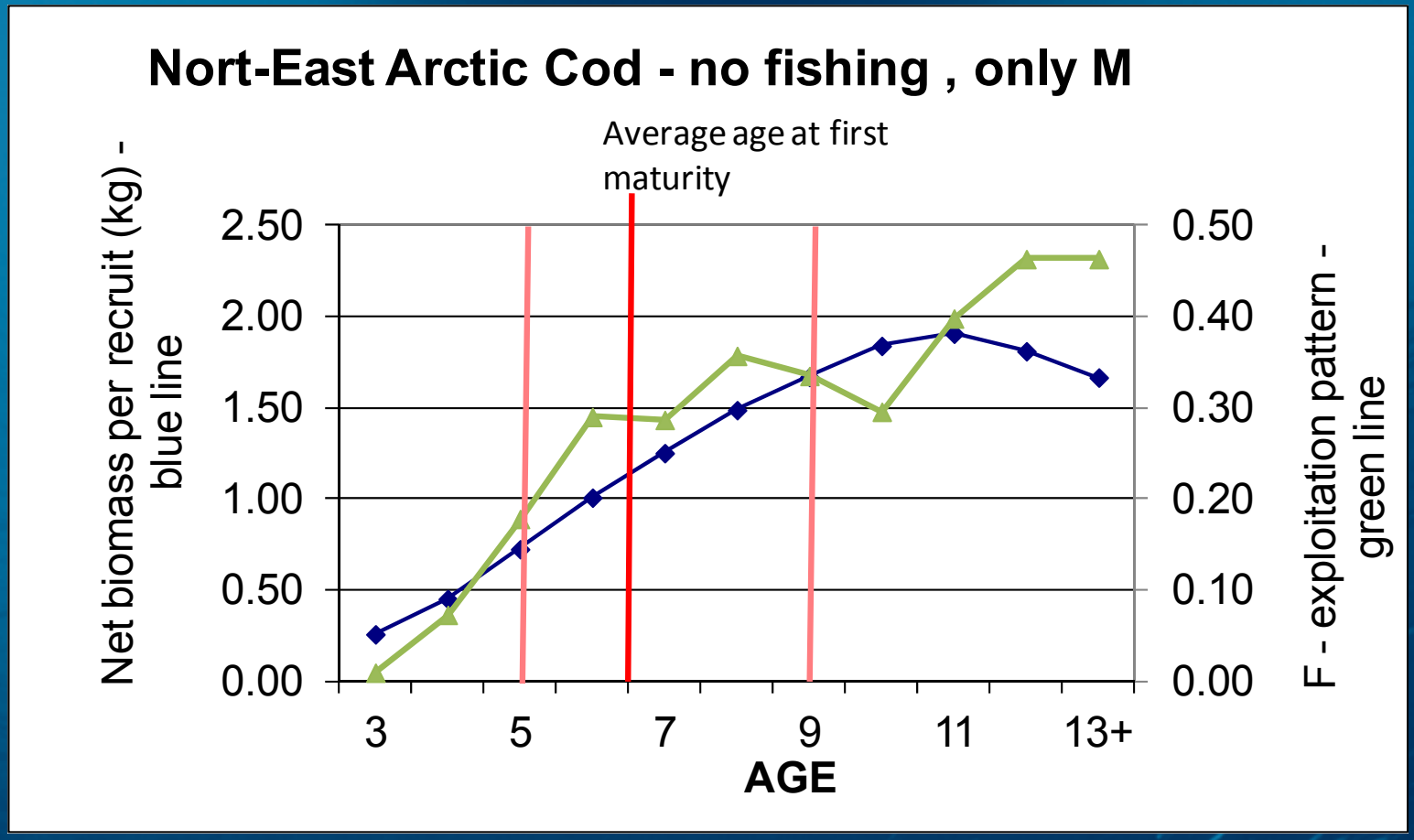
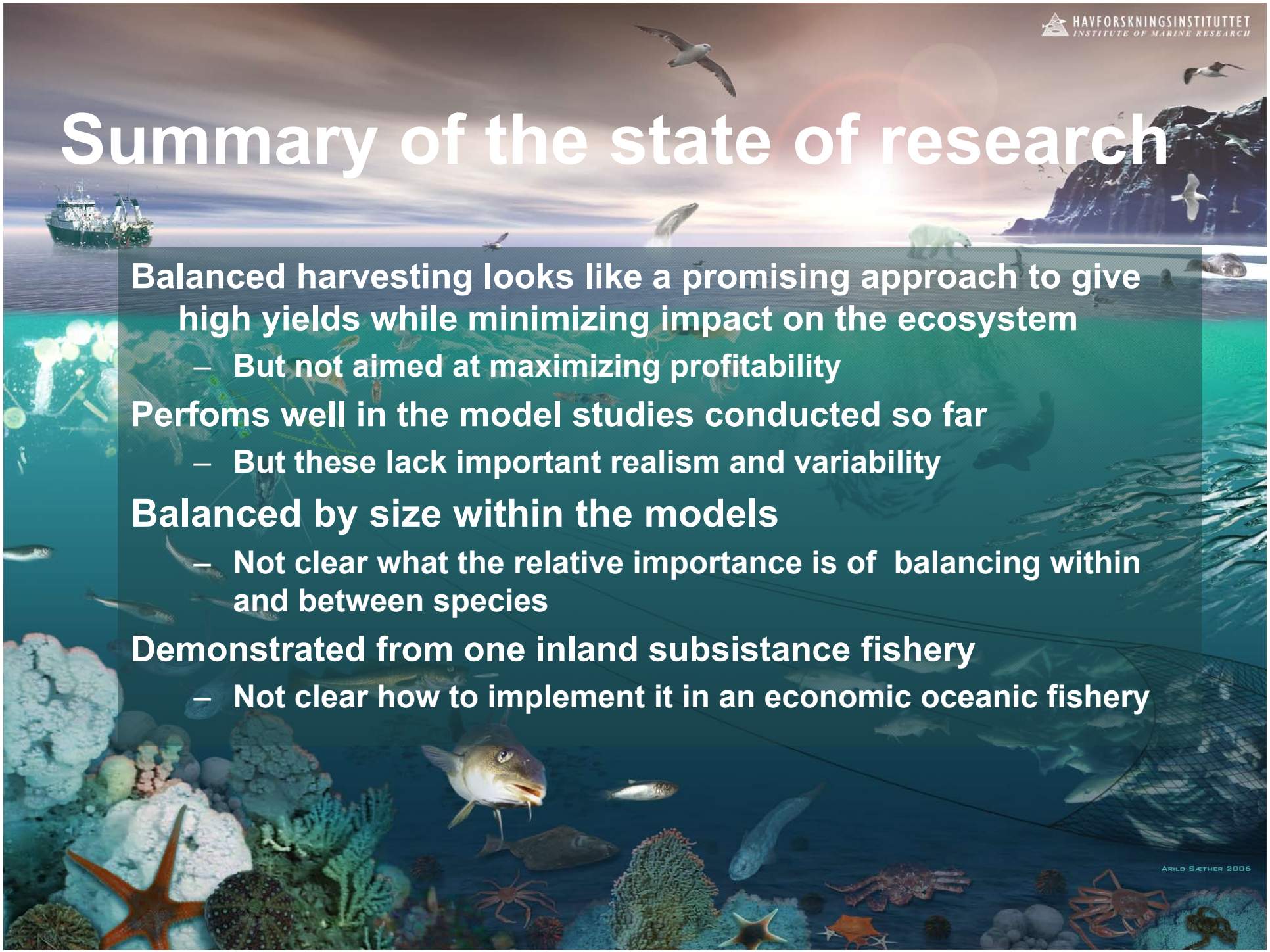
NØA torsk – dagens beskatningsmønster, balansert høsting?

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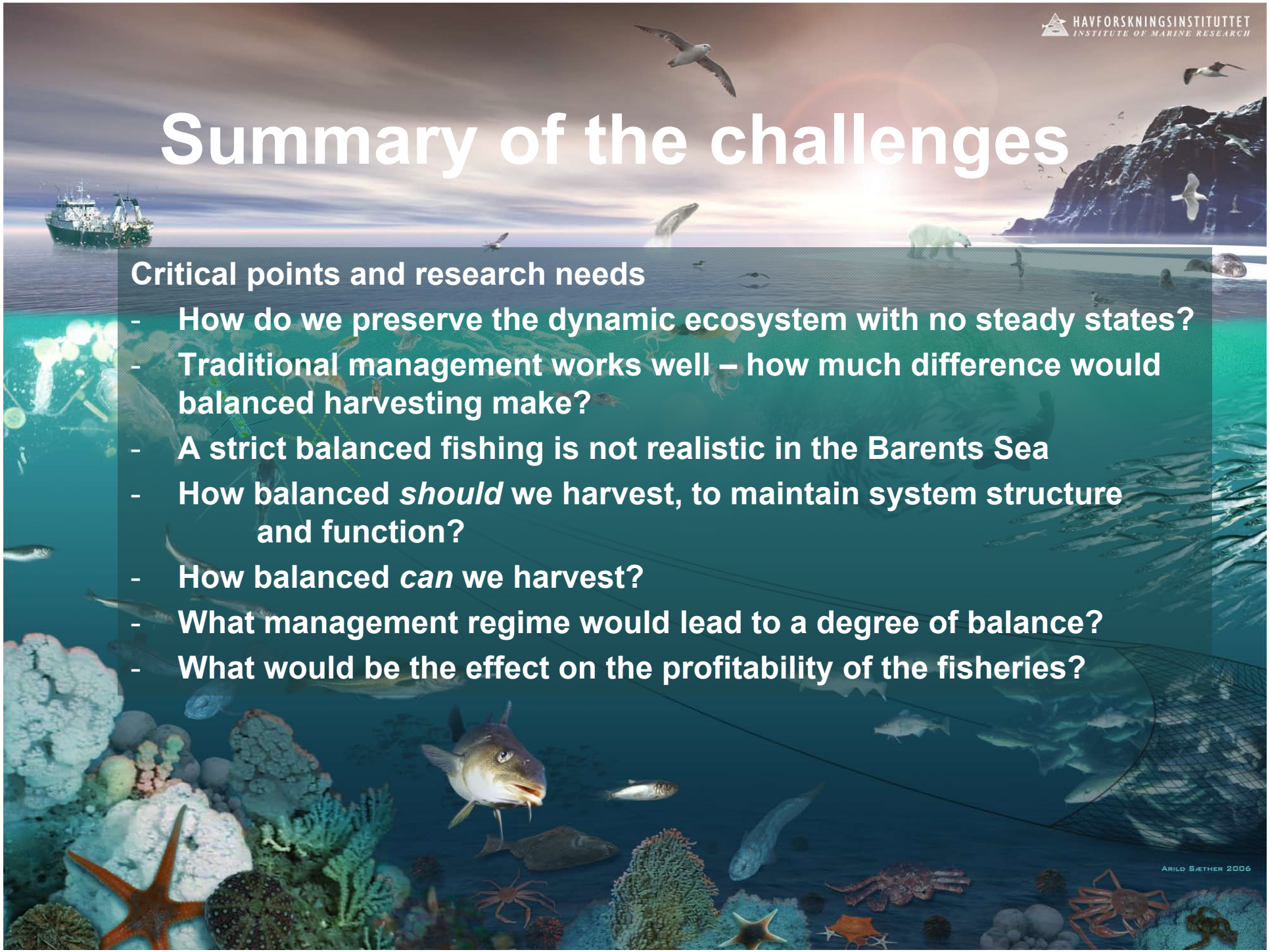
Summary of the state of research
Balanced harvesting looks like a promising approach to give high yields while minimizing impact on the ecosystem
– But not aimed at maximizing profitability
Perfoms well in the model studies conducted so far
– But these lack important realism and variability
Balanced by size within the models
– Not clear what the relative importance is of balancing within and between species
Demonstrated from one inland subsistance fishery
– Not clear how to implement it in an economic oceanic fishery
Arild Sæther 2006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Summary of the challenges
Critical points and research needs
- How do we preserve the dynamic ecosystem with no steady states?
- Traditional management works well – how much difference would balanced harvesting make?
- A strict balanced fishing is not realistic in the Barents Sea
- How balanced *should* we harvest, to maintain system structure and function?
- How balanced *can* we harvest?
- What management regime would lead to a degree of balance?
- What would be the effect on the profitability of the fisheries?
Arild Sæther 2006


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Balanced harvest in the Barents Sea?
Thank you for your attention
Arild Sæther 2006