
HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH

Drivers of Dynamics of Small Pelagic Fish Resources
Victoria, BC, Canada
March 6 – 11, 2017

Climate variability as a causative factor in sustained reduced recruitment in Norwegian spring-spawning herring

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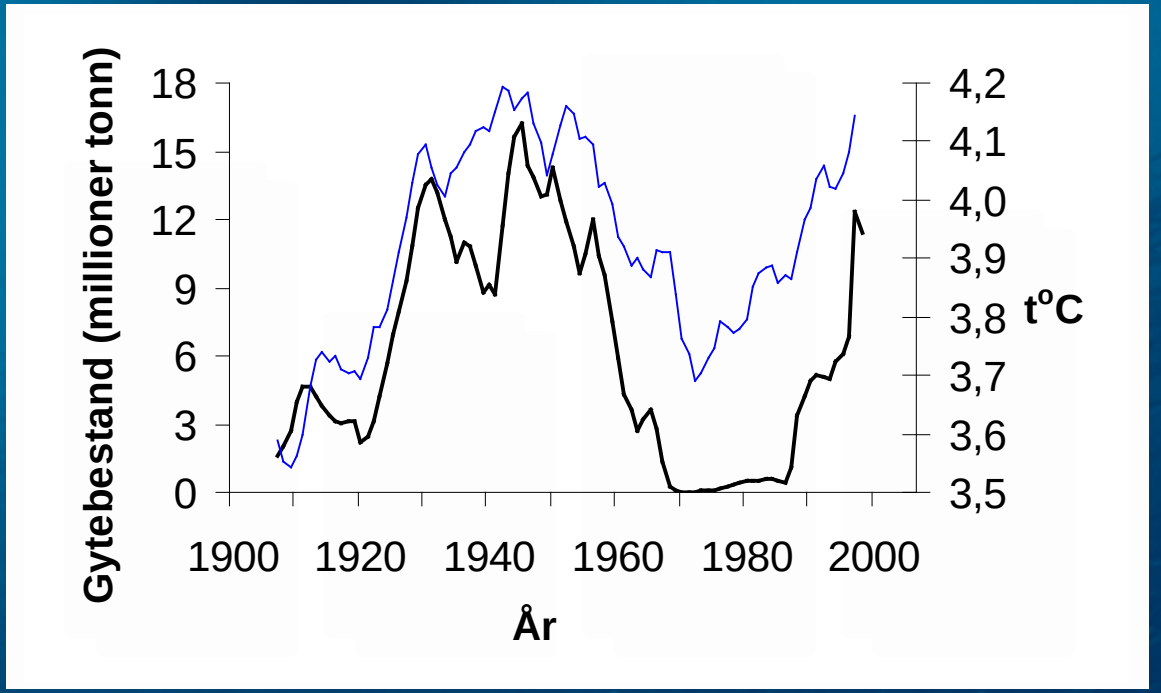
Norwegian spring spawning herring, - a stock with long time series of data

SSB and mean annual temperature at the Kola-section

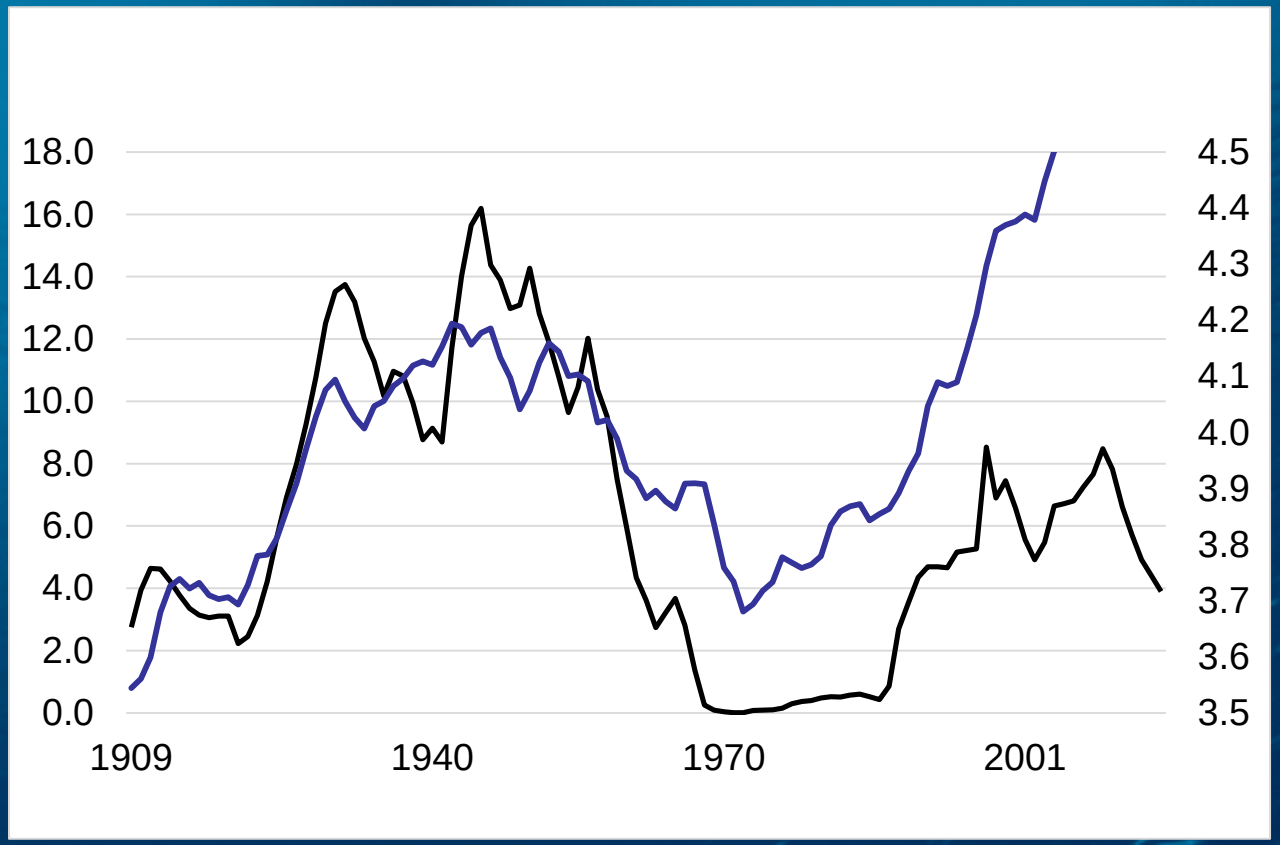
$r^2 = 0.82$



Toresen and Østvedt
Fish and Fisheries 2000, 1

Prolonged time series of SSB versus temperature

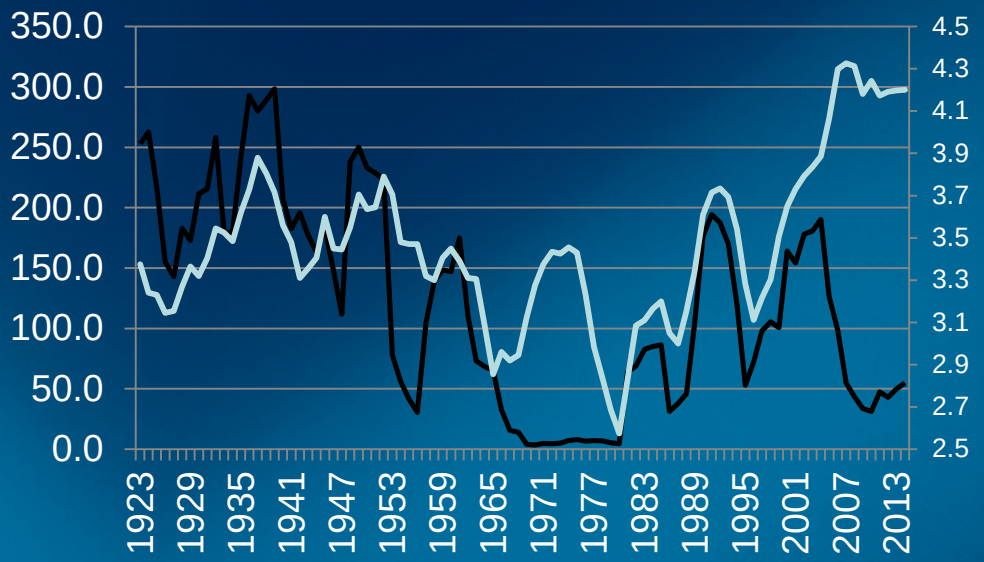
The relationship fail to continue in 2005

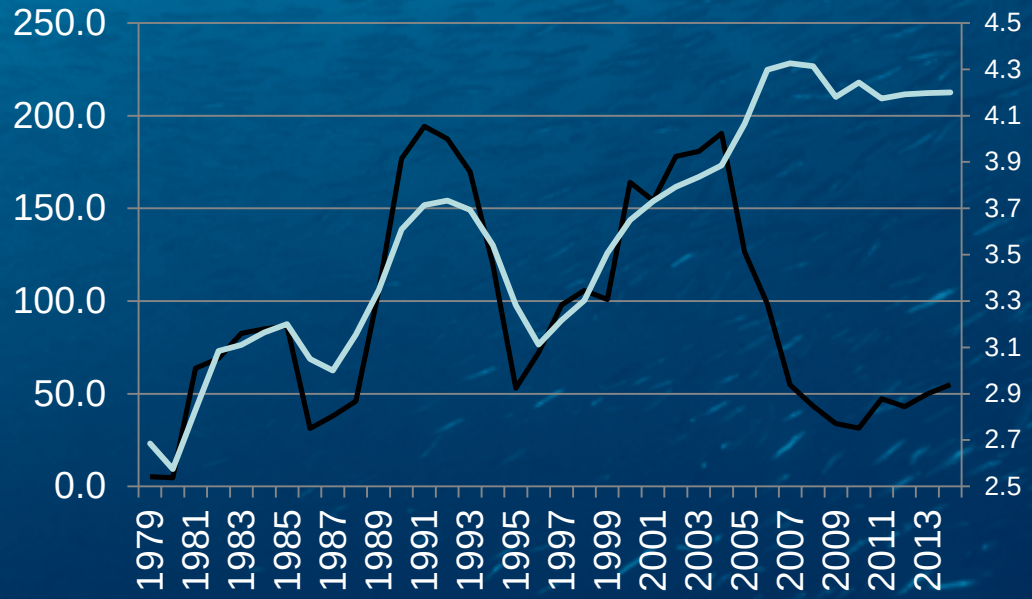


Recruitment (0-group) versus winter temperature at the Kola section (Jan – Apr)

The series are significantly positive correlated for the years 1923 – 2005.

$r^2 = 0.69$





What can explain the strong signal?

- Predation?
  - ➢ There is always heavy predation.

- In successful years a fraction of the larvae have a decreased risk of beeing eaten.

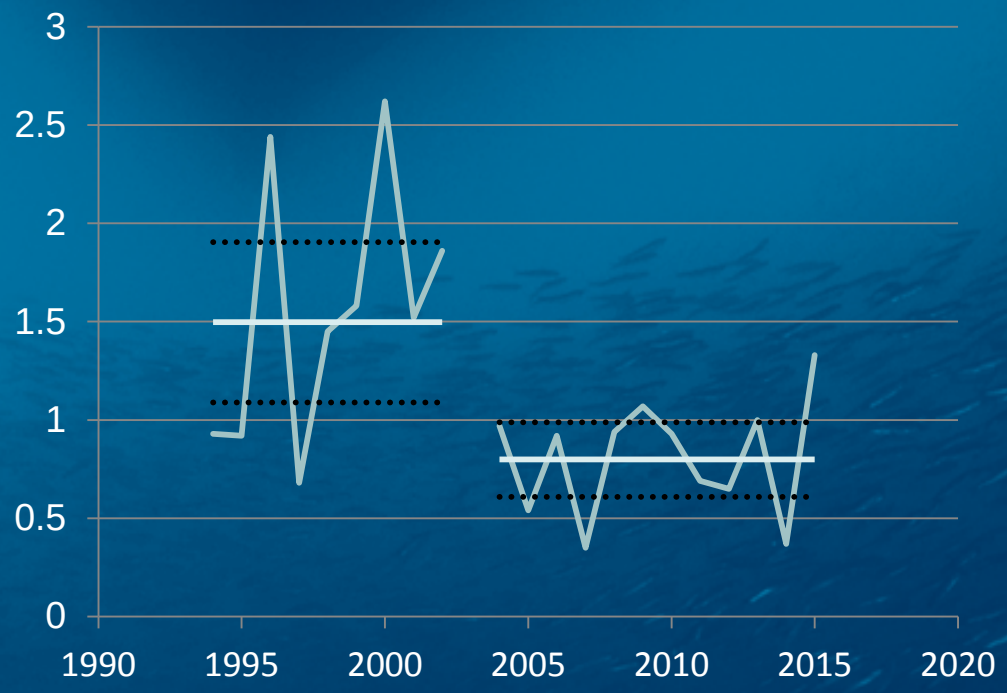
- What makes the difference when just a somewhat larger proportion of the larvae survive to create a rich year-class?

  - ➢ Variation in abundance of potential predators?
  - ➢ Variation in growth of the larvae?

Zooplankton, herring larvae surveys in April

Biomass of zooplankton in the drift route of herring larvae

The biomass is halved when comparing the former and the later period

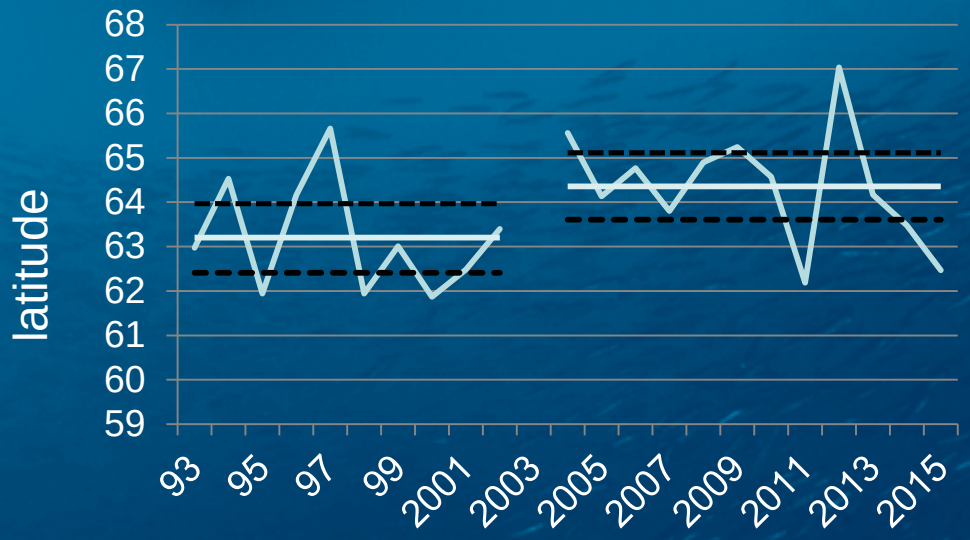


Plankton organisms - change in composition and density

Species	AV 1993-2001	AV 2006-2013	AV + (1.96 x STERR)
Acartia	2505	1502	2081
Bryozoa Cyphonautes	6144	2432	
Calanus finmarchicus	100991	50456	69948
Cirripedia	4576	2228	3195
Copepoda	76035	48314	117389
Echinodermata	6272	3405	6483
Euphausiacea	15776	11676	21565
Fritillaria borealis	15646	4548	8512
Gastropoda		1240	1349
Metridia lucens		760	1101
Metridia sp.	4140	1237	
Microcalanus pusillus	14944	13296	20193
Obelia		363	
Oikopleura	35688	506	
Oithona	36083	22646	34057
Polychaeta	2224	1600	
Pseudocalanus	7784	4533	5912

Center of gravity for zooplankton, 1993 - 2015

Zooplankton have a more northern distribution after 2005

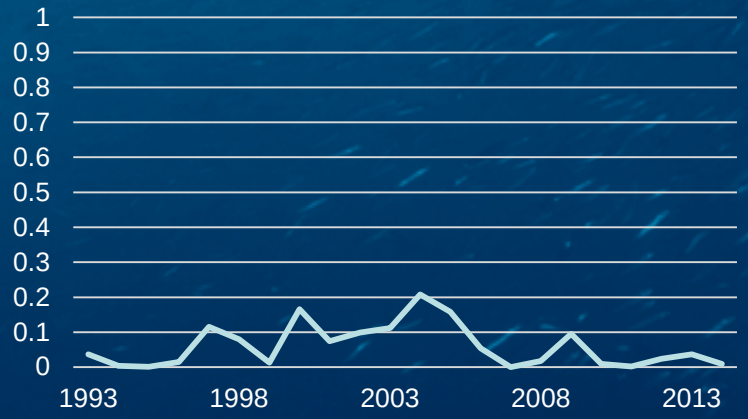


Proportion of herring larvae in three main spawning areas

Møre
south

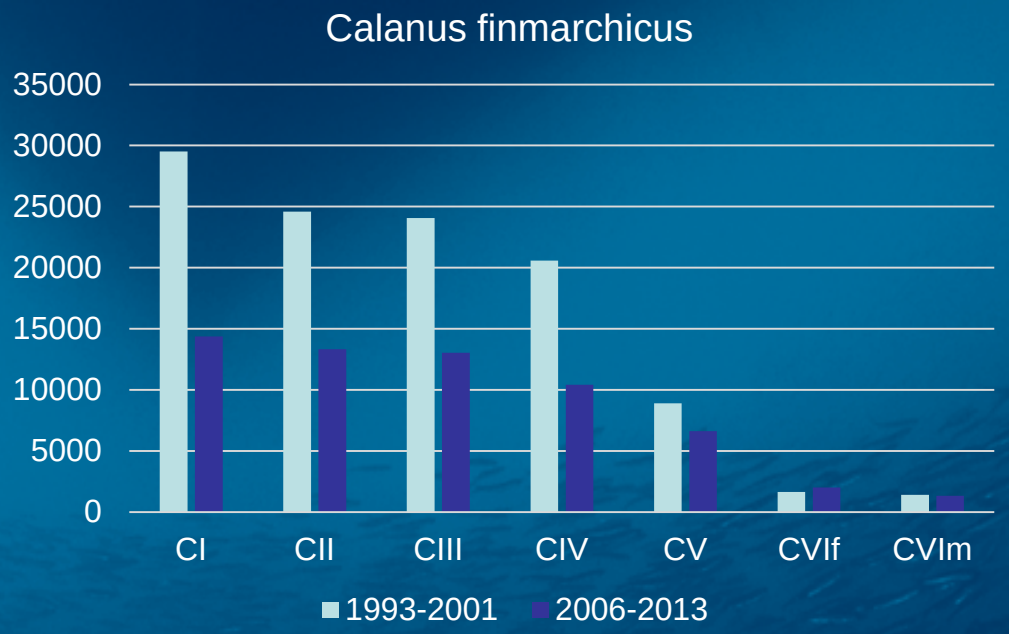
Halten
middle

Lofoten
north



Density of various stages of Calanus finmarchicus

1993 – 2001 and 2006 - 2013



Indicating a real reduction in the abundance of Calanus finmarchicus

Conclusions

- Reduced recruitment for NSSH since 2005
- Significant increase in heat content in the Norwegian Sea and at the Norwegian coast
- Reduced zooplankton biomass and density
- Reduced overlap between plankton and herring larvae
- Reduced growth of larvae leading to higher risk of beeing eaten can be a mechanism for sustained low recruitment in the recent 12 years


Thank you for the attention!