Environmental drivers of peak recruitment years of Norwegian Spring Spawning Herring (*Clupea harengus* L.)

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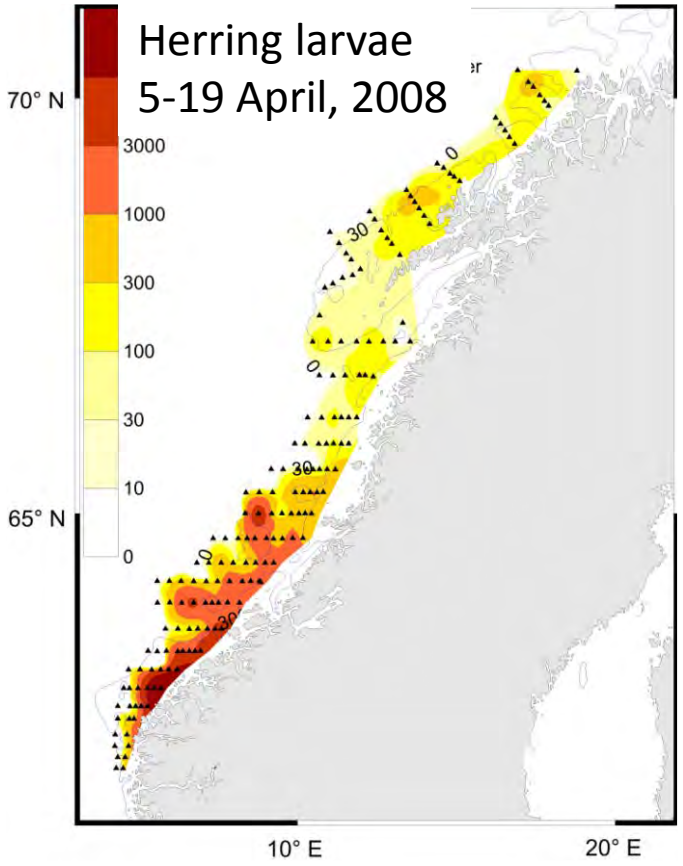
IMR, Norway

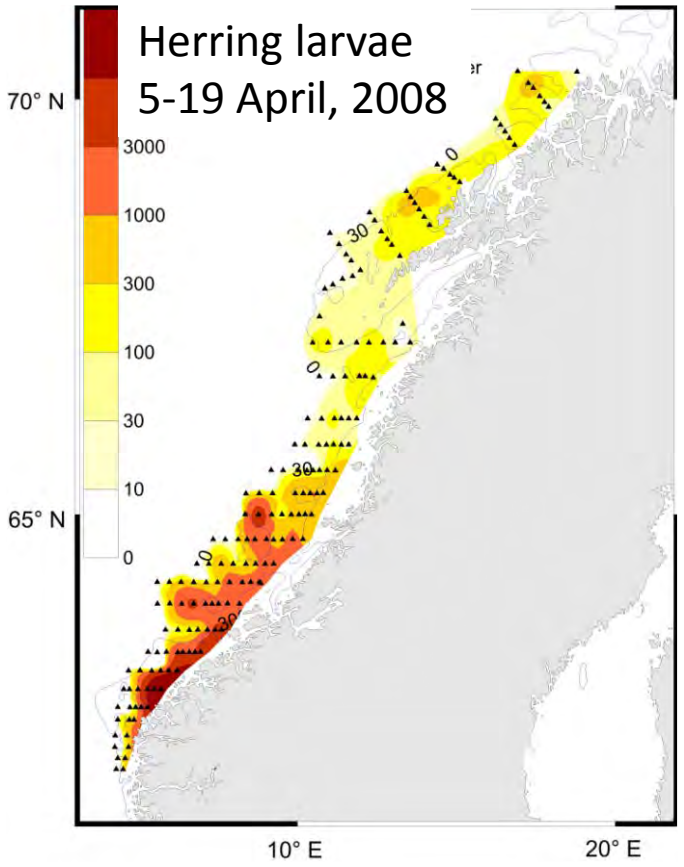


Skagseth et al., 2015

Herring Recruitment studies: rapid drift, retention at banks, +++

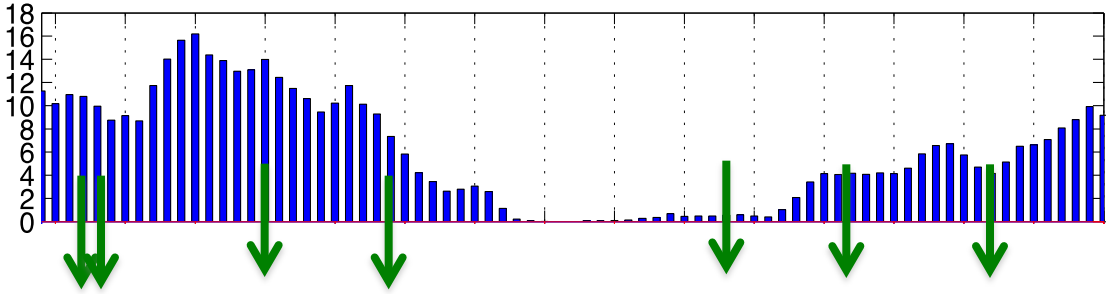
Characteristics of the Norwegian Coastal Current during years with **high** recruitment of Norwegian Spring Spawning herring (*Clupea harengus* L.)

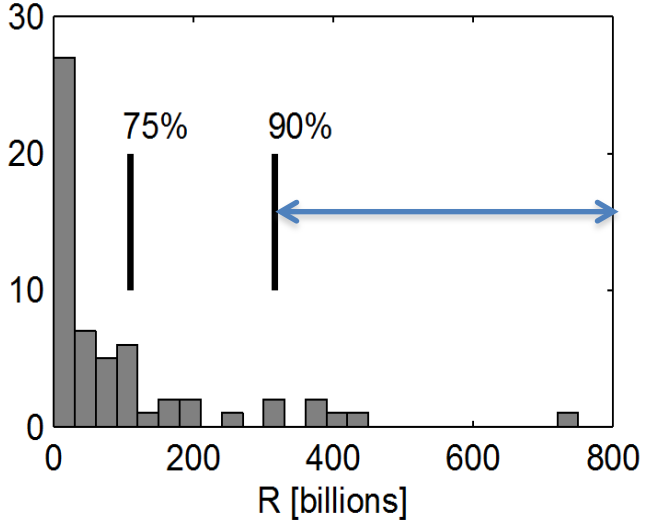
Main environmental drivers in a coastal system:
-along coast **wind field (up-/downwelling),** 64-68ºN
-**Density contrast, hydrography.**
Period March-August, from larval stage to metamorphosis



Skagseth et al., 2015

NSSH: biomass, recruitment, survival



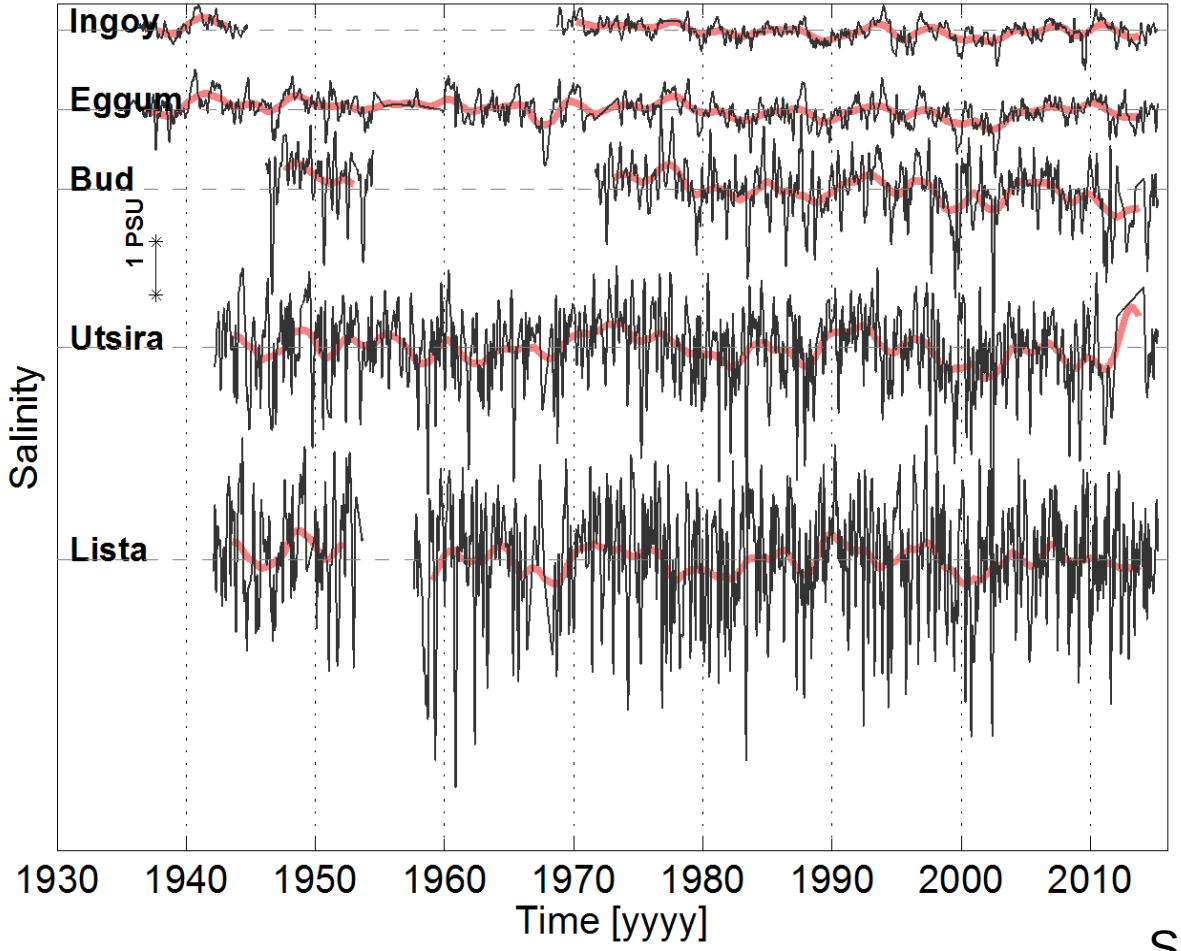


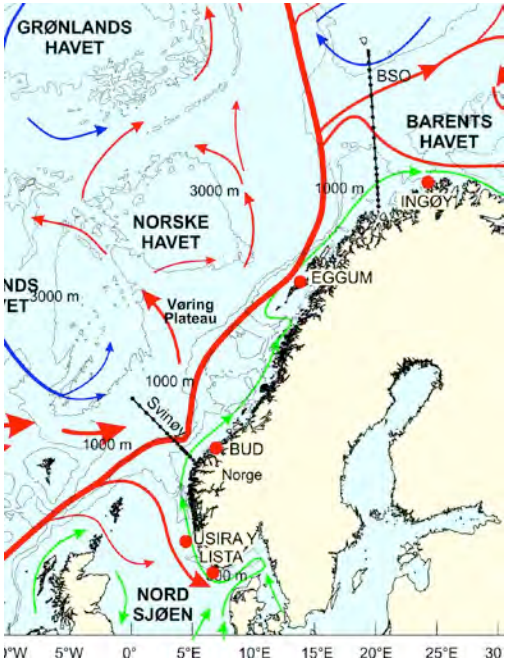
Note: Few very large recruitment years -> *stock dynamics is essentially driven by these very infrequent episodic events*. Long time-series: identify common environmental conditions that occur during the peak recruitment years *(in article the upper 90th%ile).* Two leading peak years (R + survial): **1983 and 2002**

NB! Period March-August, from larval stage to metamorphosis

Skagseth, Slotte, Stenevik, Nash *2015*.

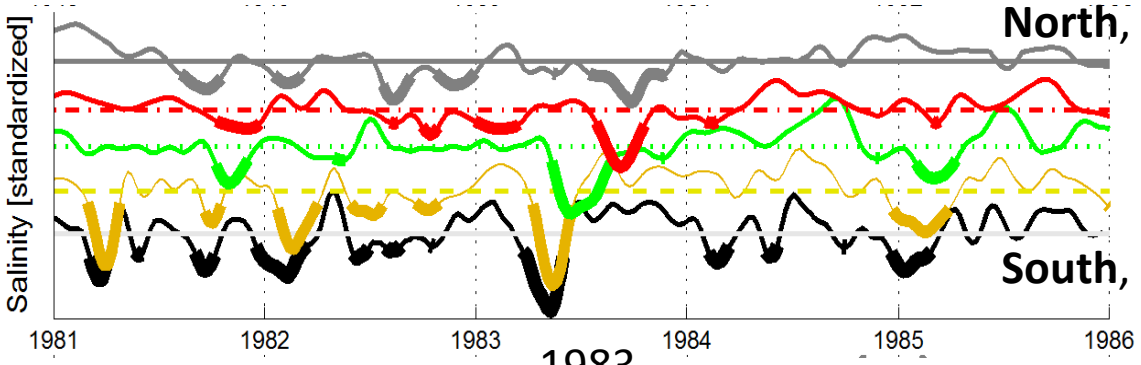
Salinity in the Norwegian Coastal Current





Salinity (0-30)m, de-seasoned

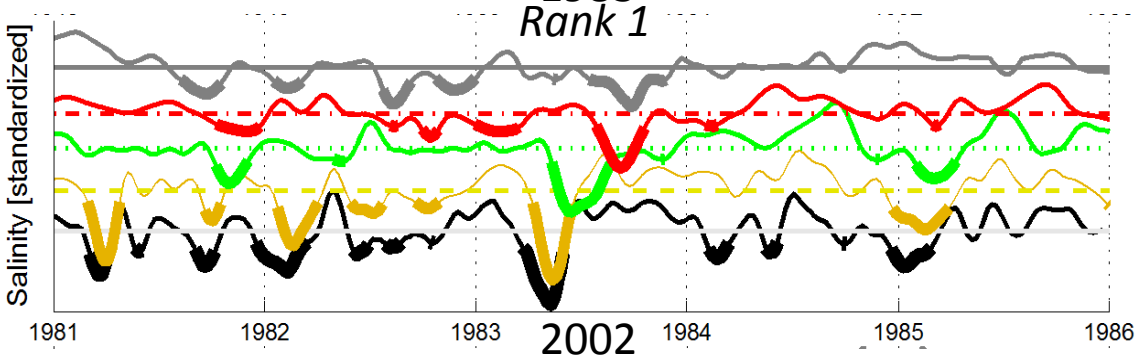
Freshwater in the Norwegian Coastal Current: at peak recruitment years 1983 and 2002



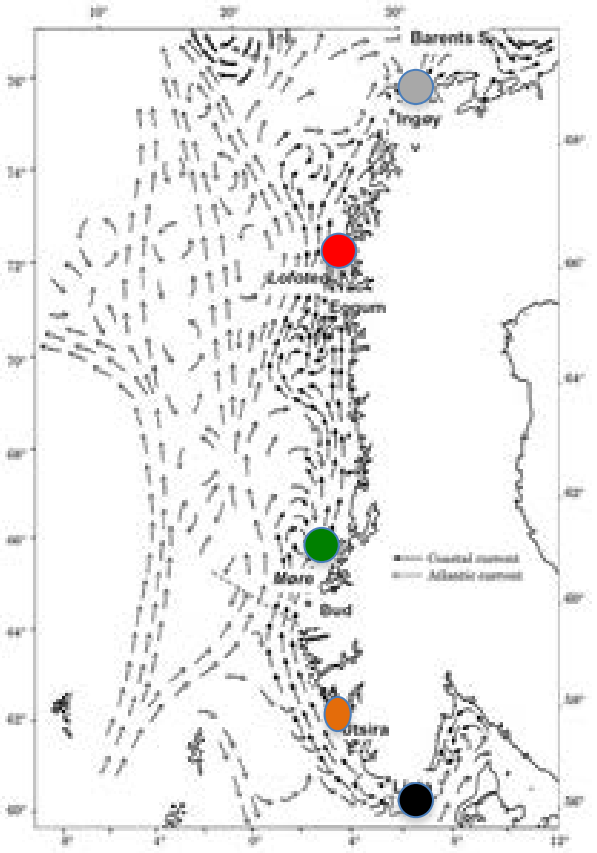
North, Eggum

South, Lista

1983
Rank 1



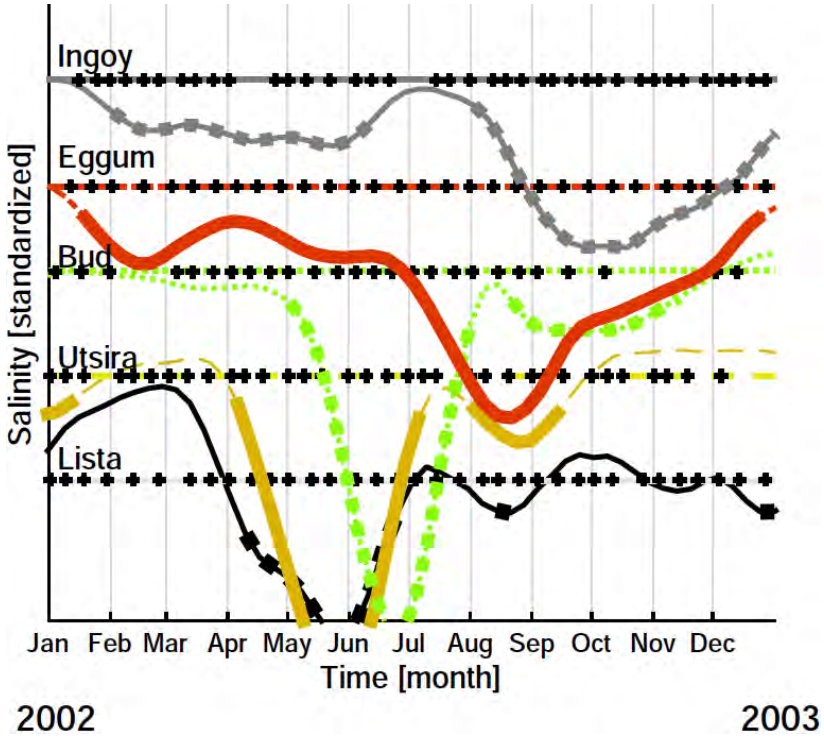
2002
Rank 2



Note: Data de-seasoned, one-month low-pass, mean upper [0-30]m

Skagseth, Slotte, Stenevik, Nash *2015*.

Effects of freshwater anomalies

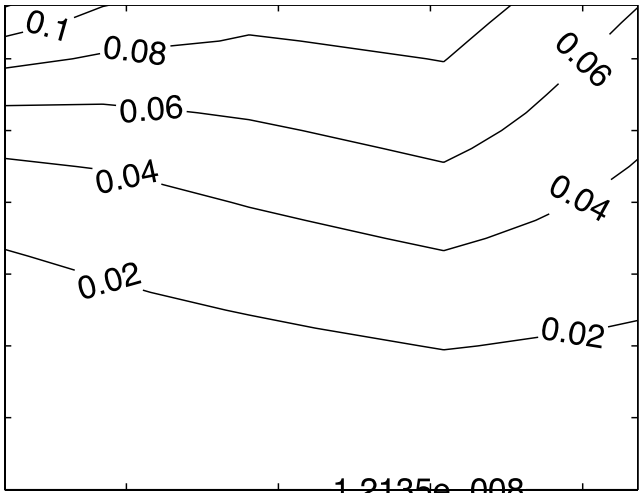


- Change the visibility in the NCC → darker water, less predation
- Increased stability
- Changing (i.e. less) nutrients in Coastal Water compared Atlantic Water
- Increase density driven Norwegian Coastal Current

Density driven component of the Norwegian Coastal Current

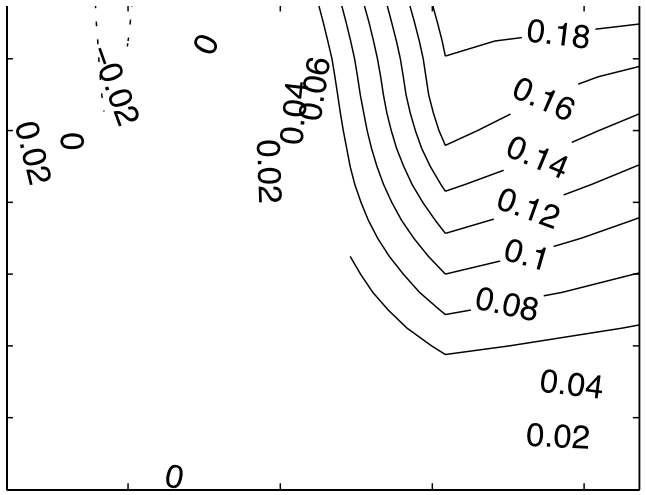
Mean: Mar-April 1986-2003

m/s



Coast

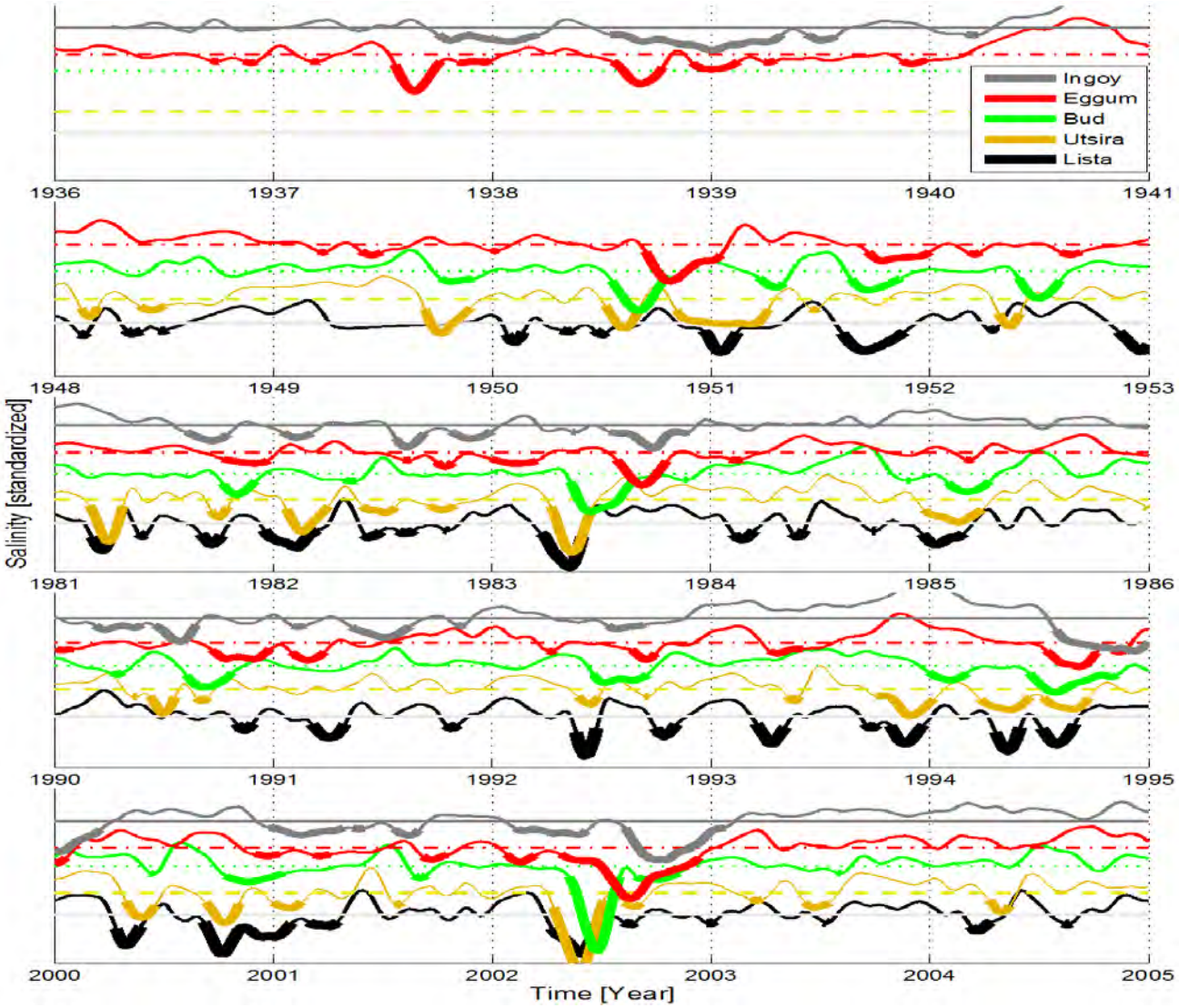
High recruitment Mar-April: 2002



Coast

Skagseth, Slotte, Stenevik, Nash *2015*.

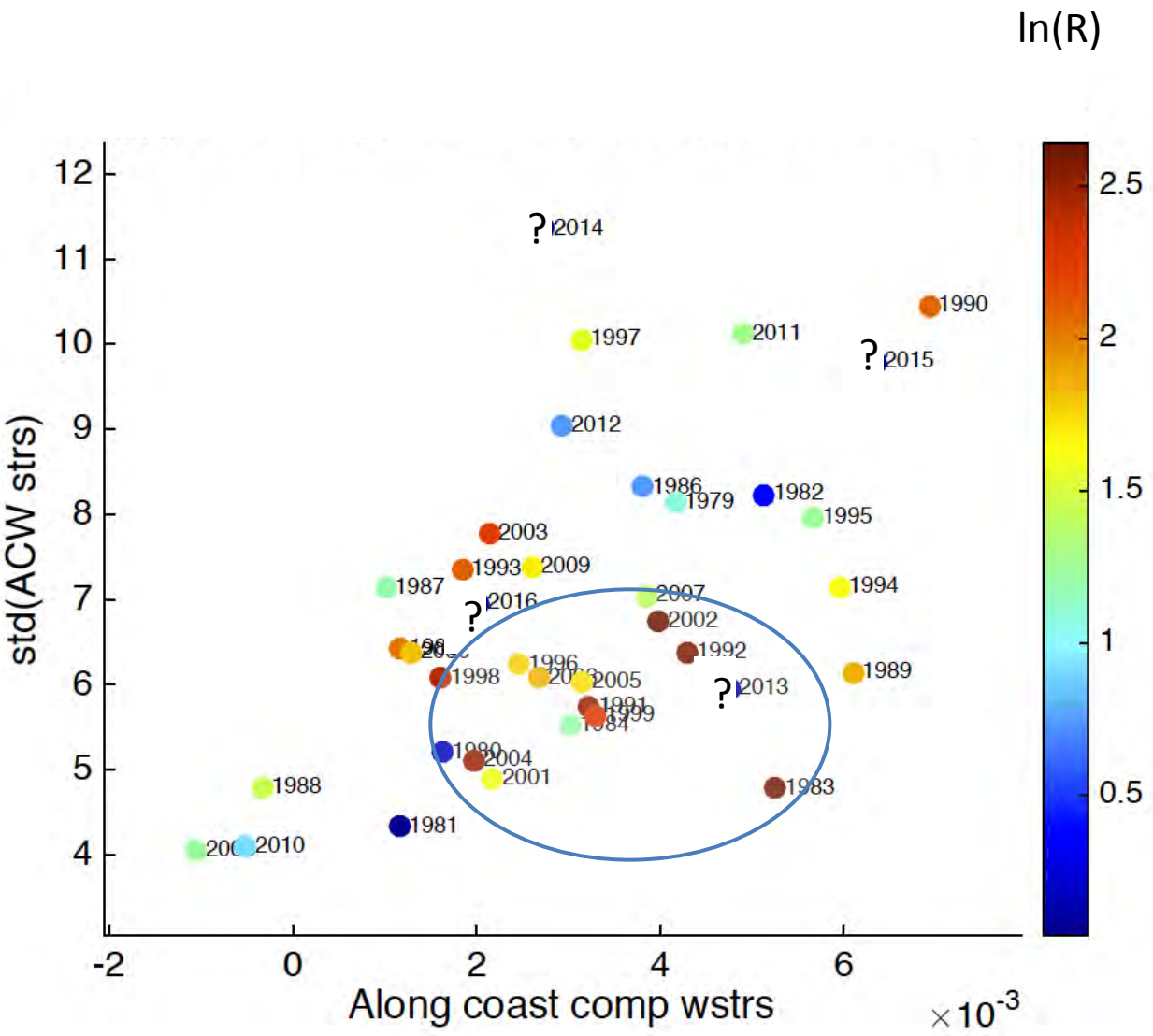
Coastal waters at peak NSSH recr



Note: hydr data de-seasoned, one-month low-pass, Mean [0-30]m

Skagseth, Slotte, Stenevik, Nash *2015*.

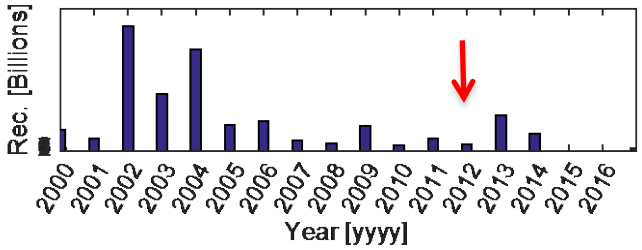
Wind and Recruitment

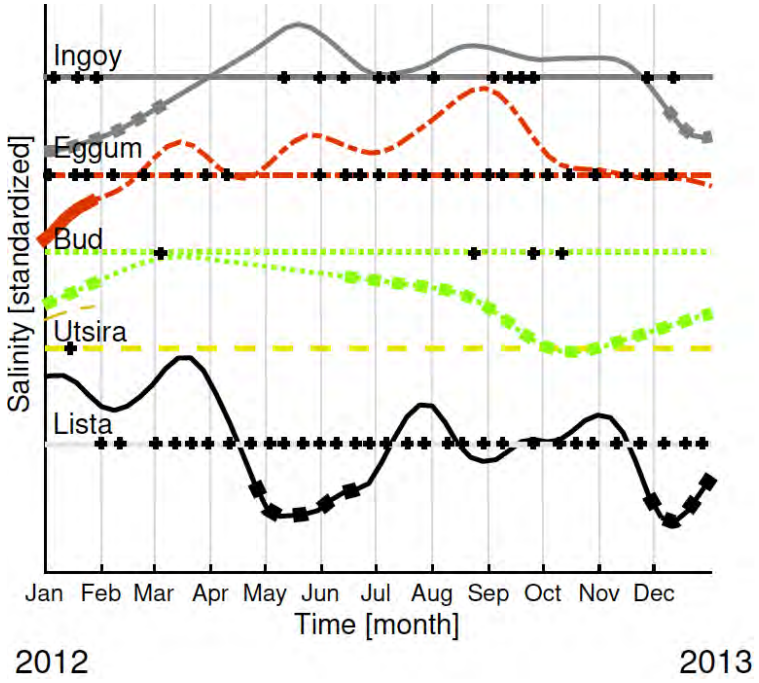


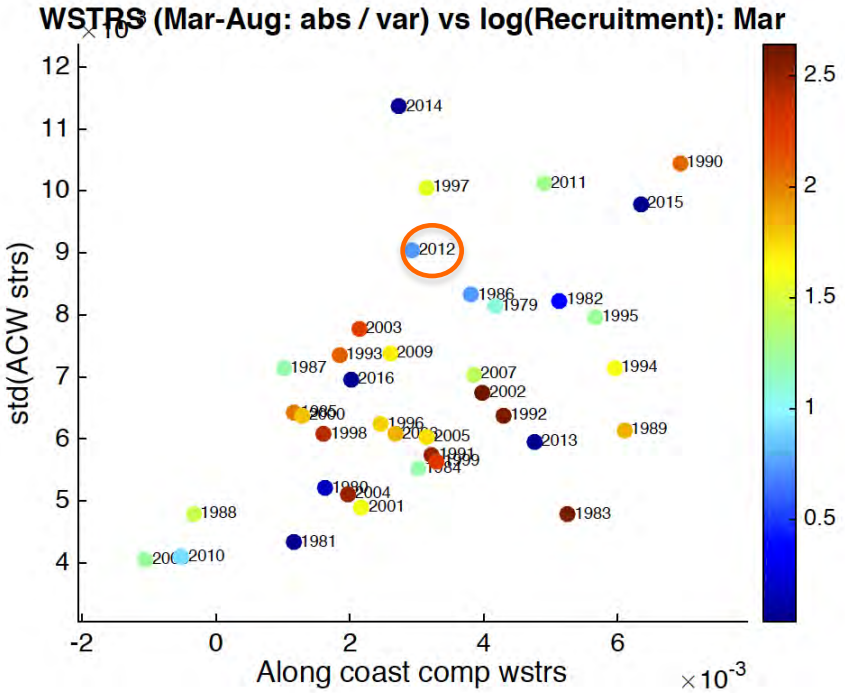
Optimal window in the phase space of
1) along coast wind and 2) variability of the ACW where elevated change for high recruitment.

Not always success: Necessary but not sufficient condition

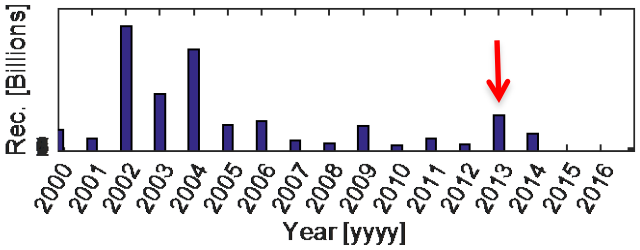
Updated R, winds and hydro (2012)



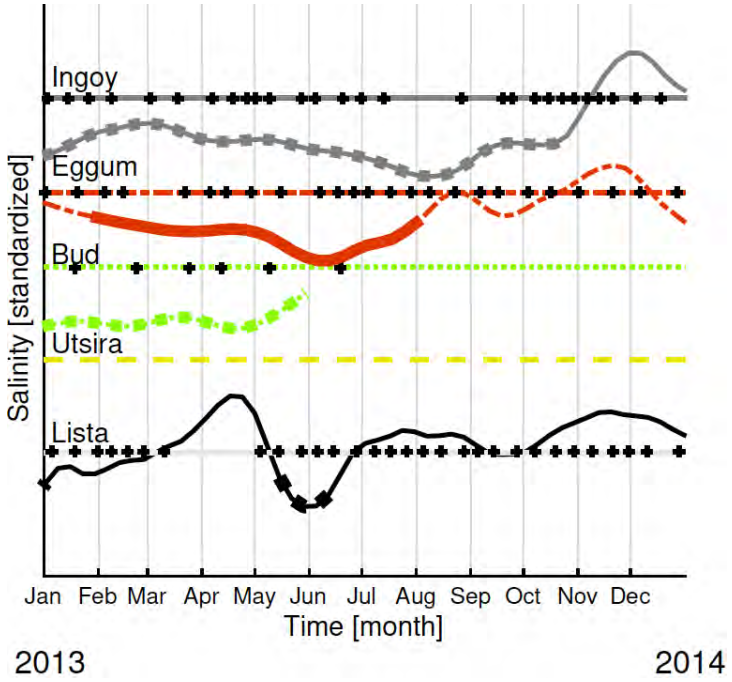


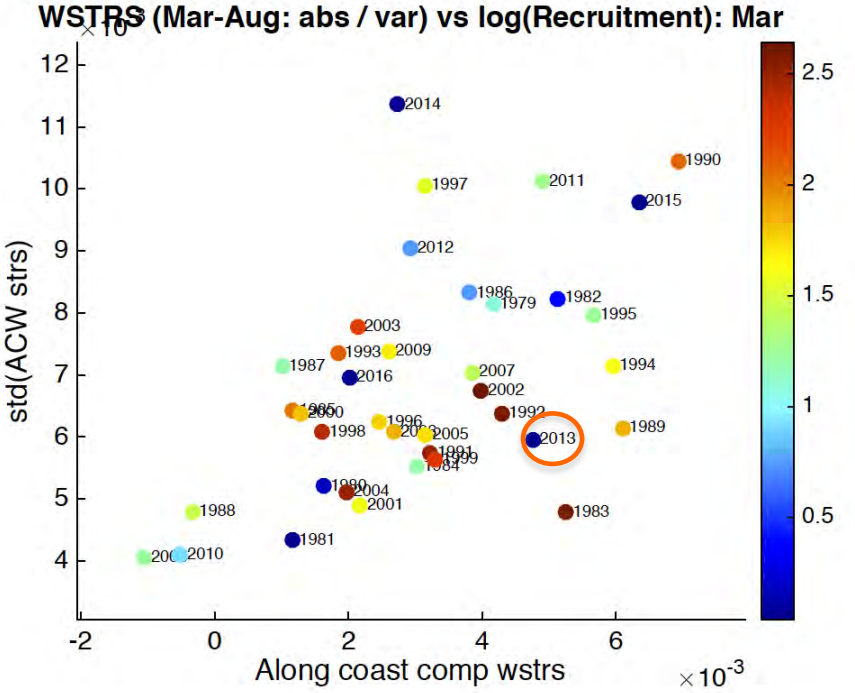


Updated R, winds and hydro (2013)

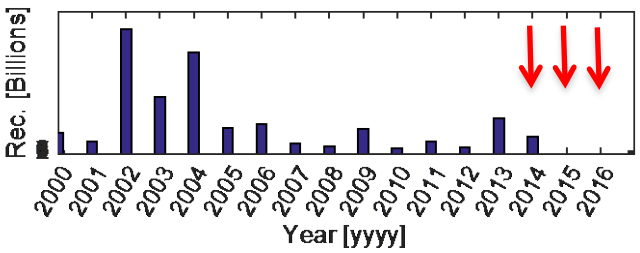


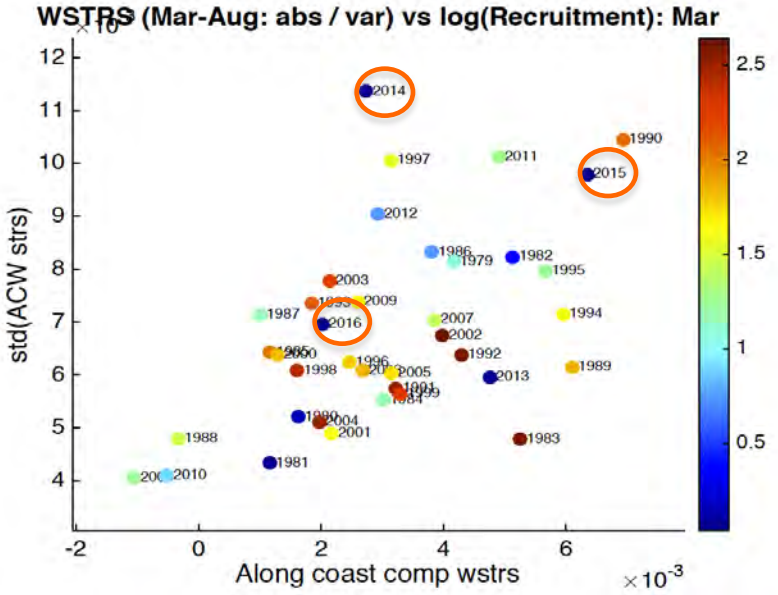
NB! Similar winds (and hydro cond) as peak R years

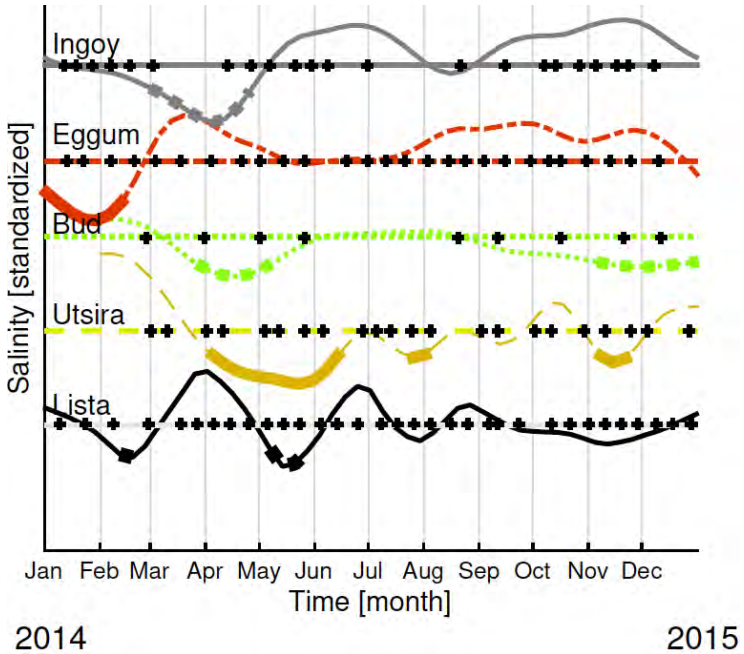


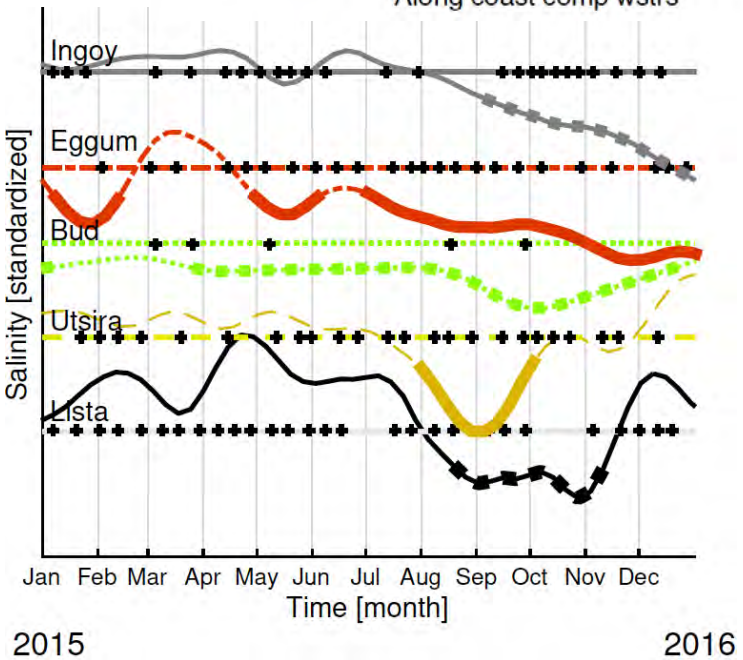


Updated R, winds and hydro (2014/15/16)









Conclusion

Success in Recruitment of Herring coincide with seasonally **anomalous** downwelling winds accompanied with a “freshwater” pulse, both contributing to retention of the larvae in the Norwegian Coastal Current and advection toward the Barents Sea nursery area.

- Seasonally anomalous explain why few good years
- “Evolution: few good years but also difficult for predators”
- Together with surveys a tool to identify years with necessary env. condition for peak recruitment → Simplify the rec. problem
- A signal found after ≈3 additional yrs in the Barents Sea indicate that this is a strong mechanism?