Calanus off Iceland

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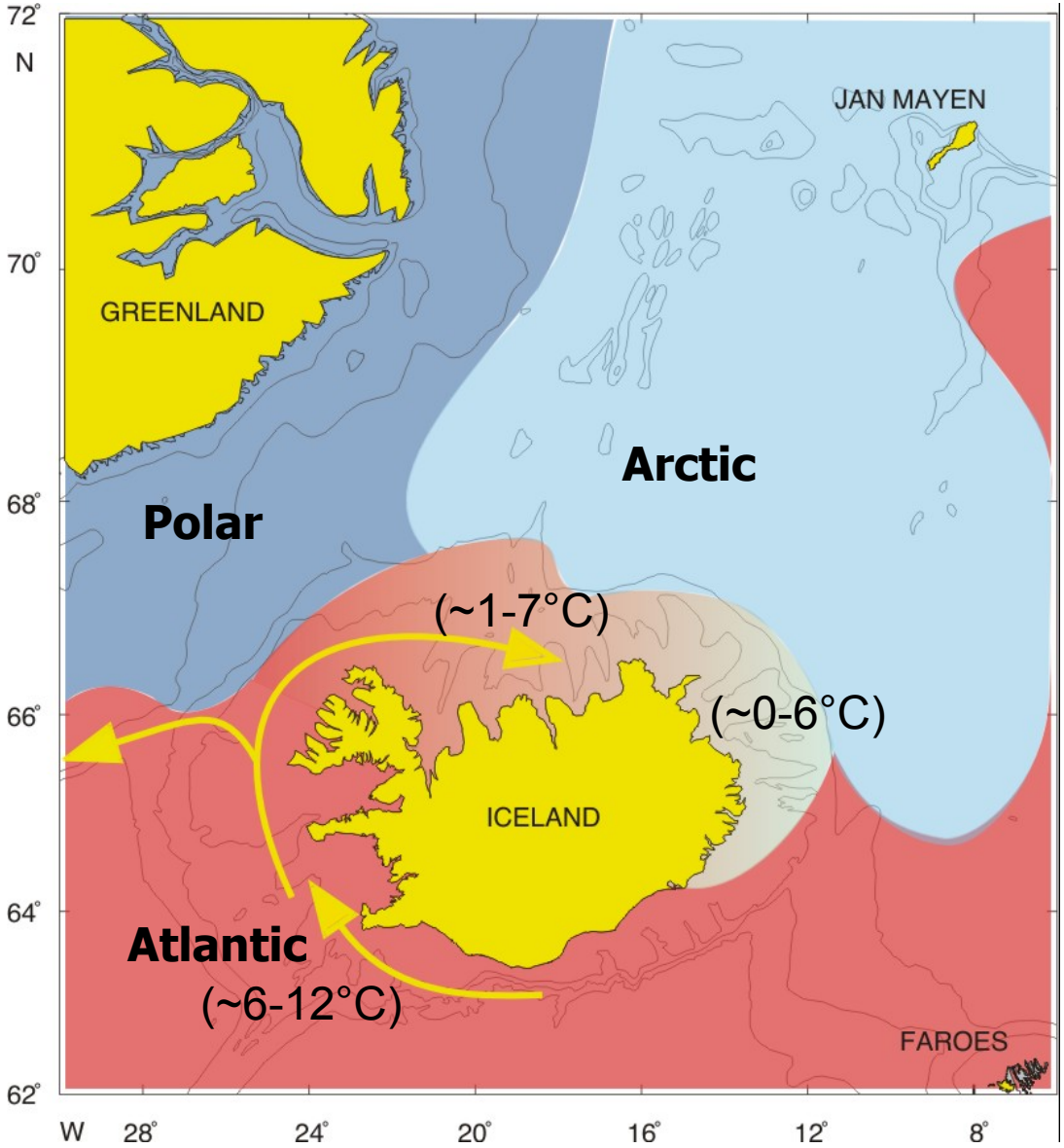
Outline of talk

- Environmental conditions
- Demography
  - Distribution
  - Seasonal abundance
  - Long-term changes
- Rates
  - Egg production
  - Ingestion
  - Overwintering mortality
- Conclusions

Hydrography

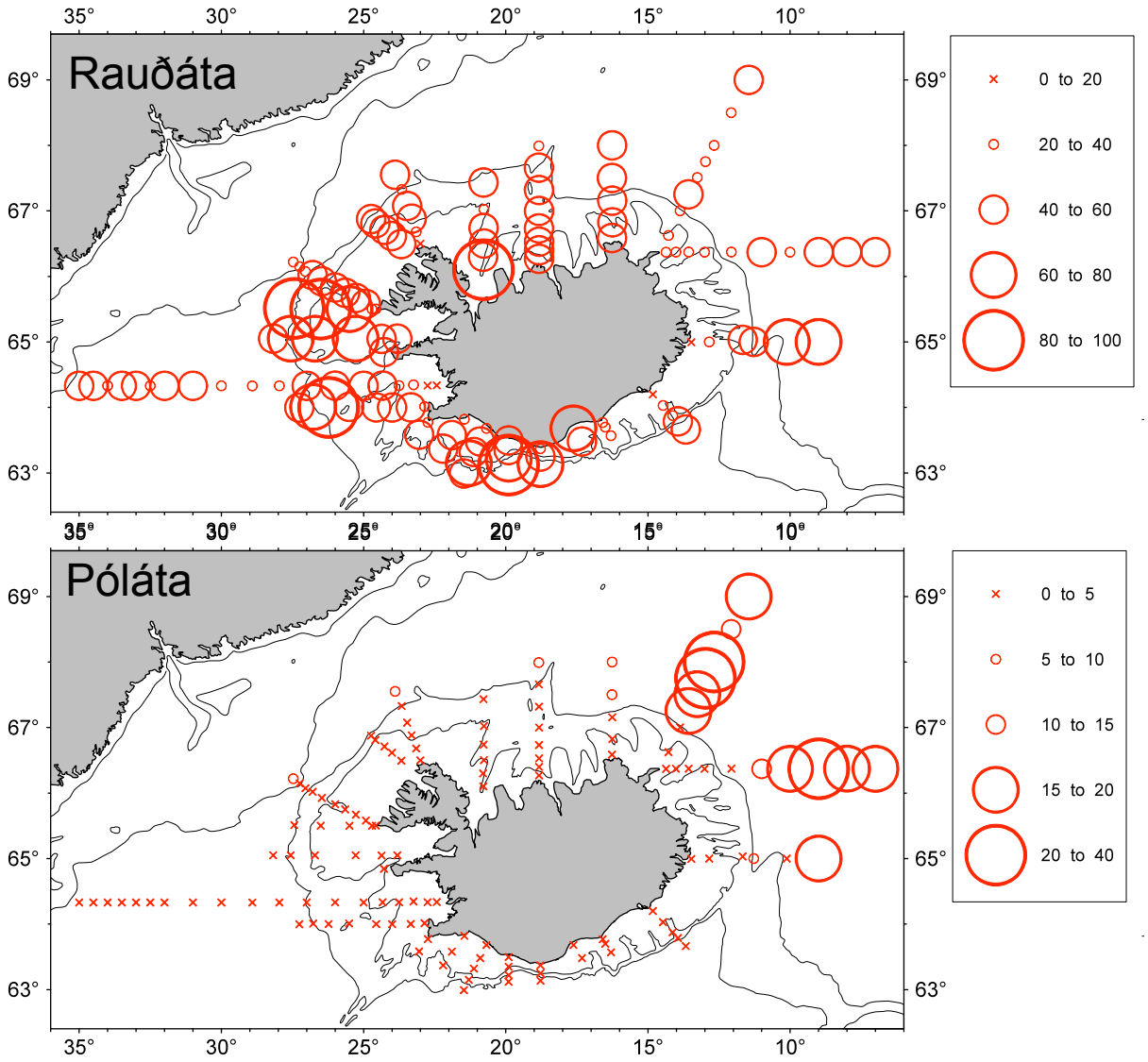


- Iceland as a transitional area
- AW in south and west
- Subarctic in north and east

Distribution (%, May-June, 0-50m)

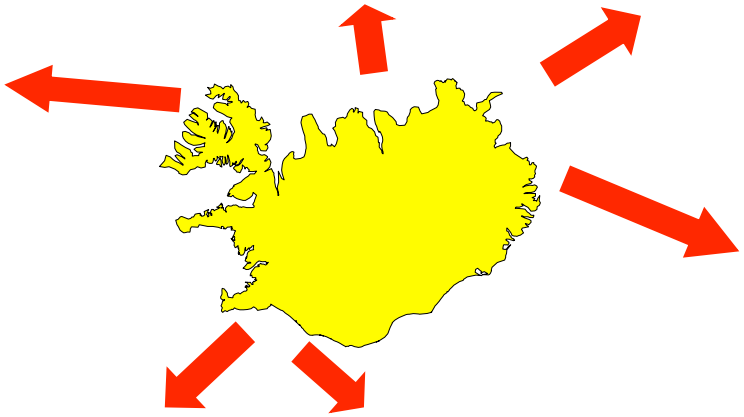
C.fin

C.hyp



- Data 1961-1999
- Cfin >~40%
- Cfin highest in SW
- Chyp highest in NE

Seasonal cycles

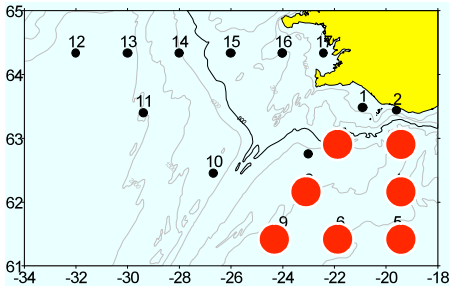


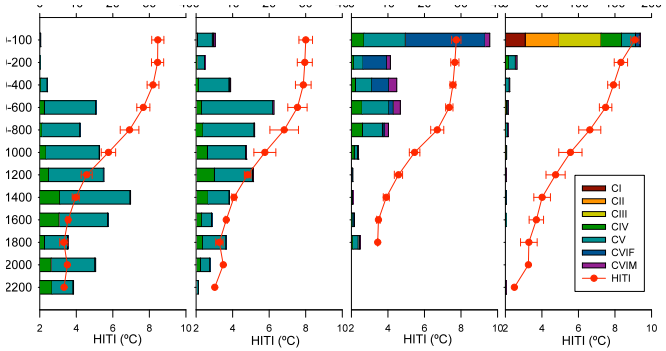
Cfin
Chyp
Other
Blaðgræna

- Total abundance higher in S than N
- Cfin highest in SW - Chyp in NE
- Cfin; two peaks in SW - one in N
- Spring bloom at similar time
- NE&E: insignificant phytoplankton biomass increase
- NE&E: close association of phyto and zooplankton

(Gislason 2002)

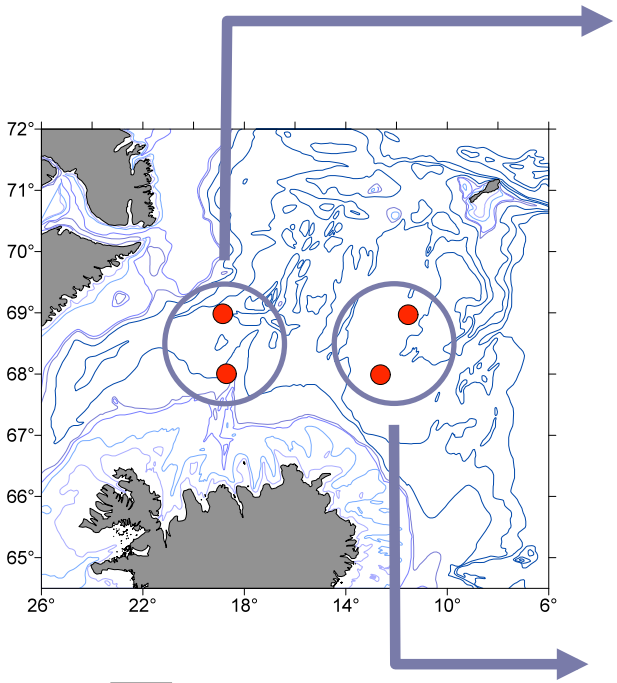
Cfin: Seasonal vertical distribution Southwest





(Gislason et al. 2000)

Cfin: Seasonal vertical distribution North



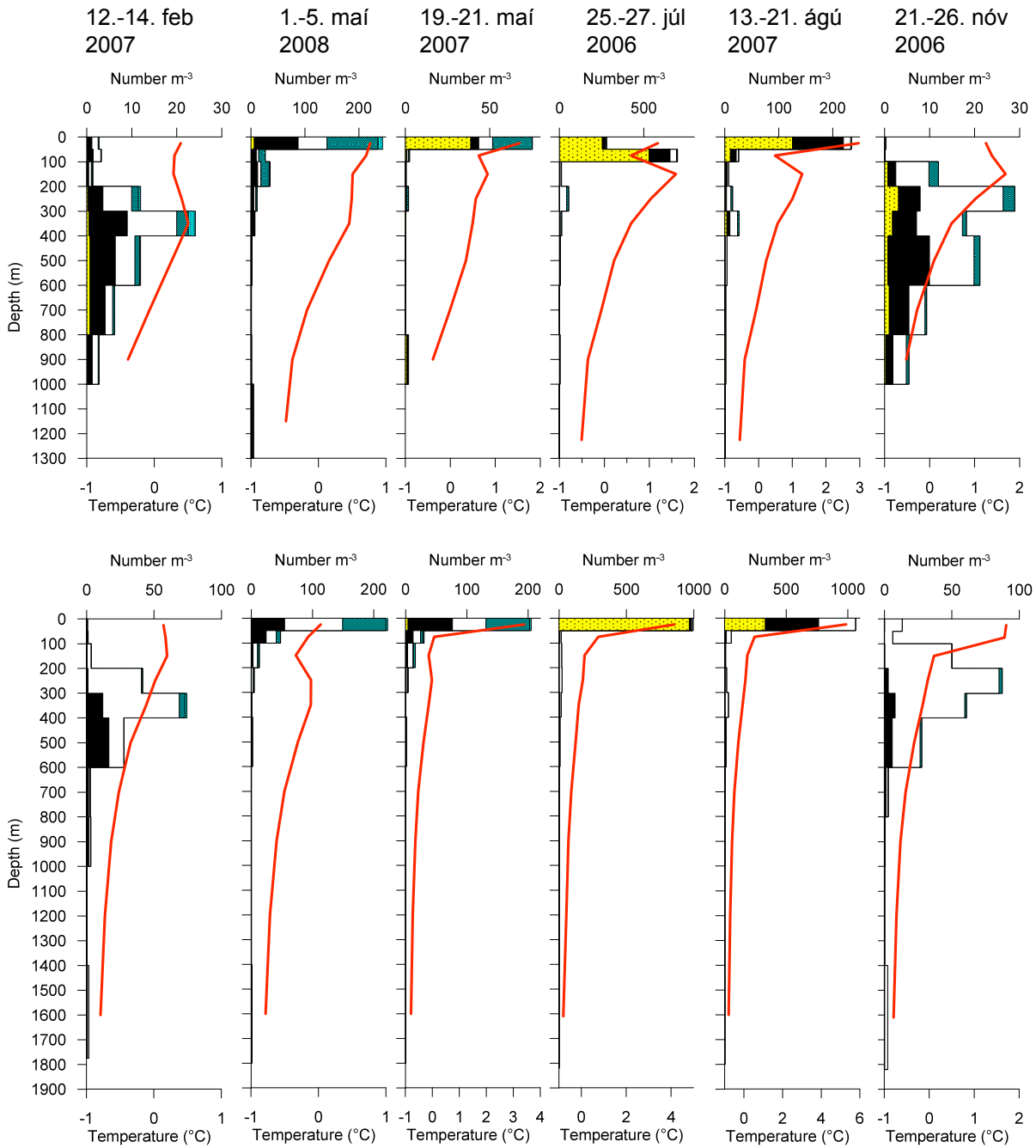
C1-3

C4

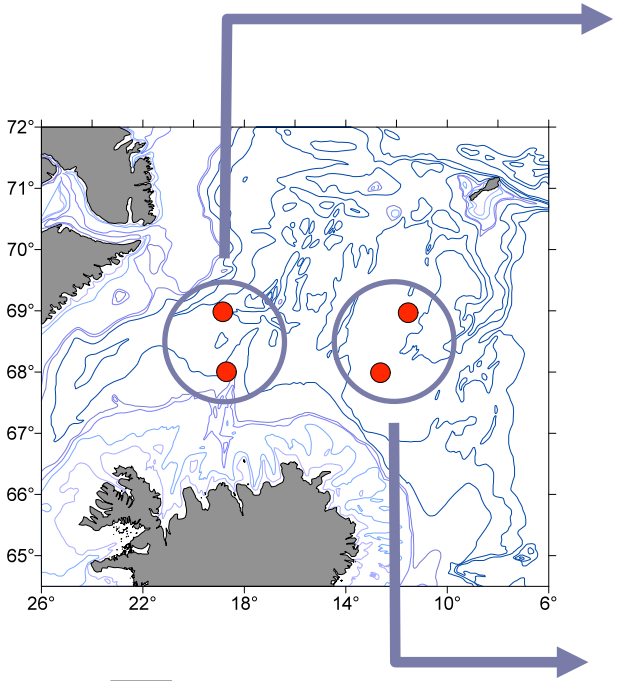
C5

C6f

C6m



Chyp: Seasonal vertical distribution North



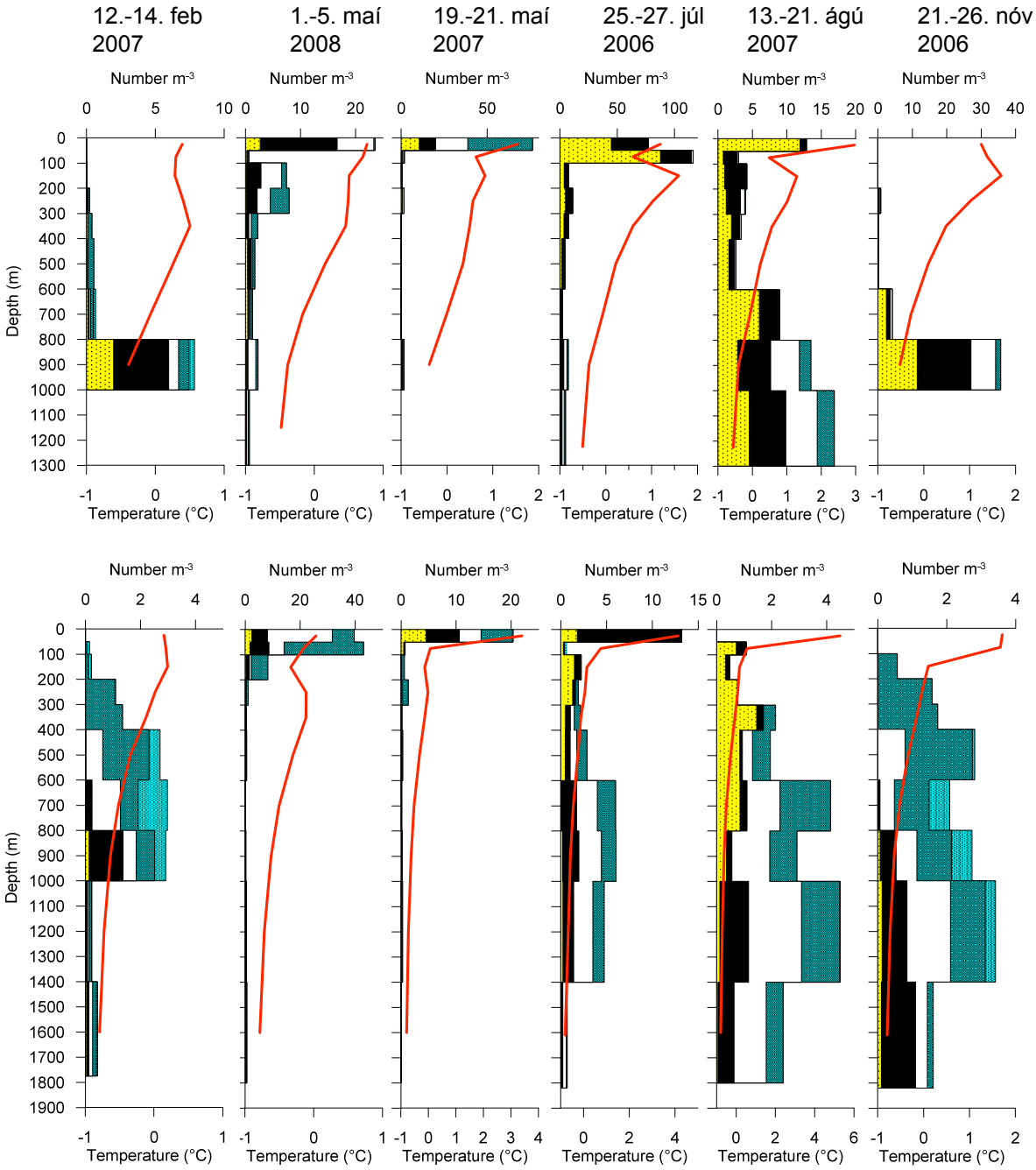
C1-3

C4

C5

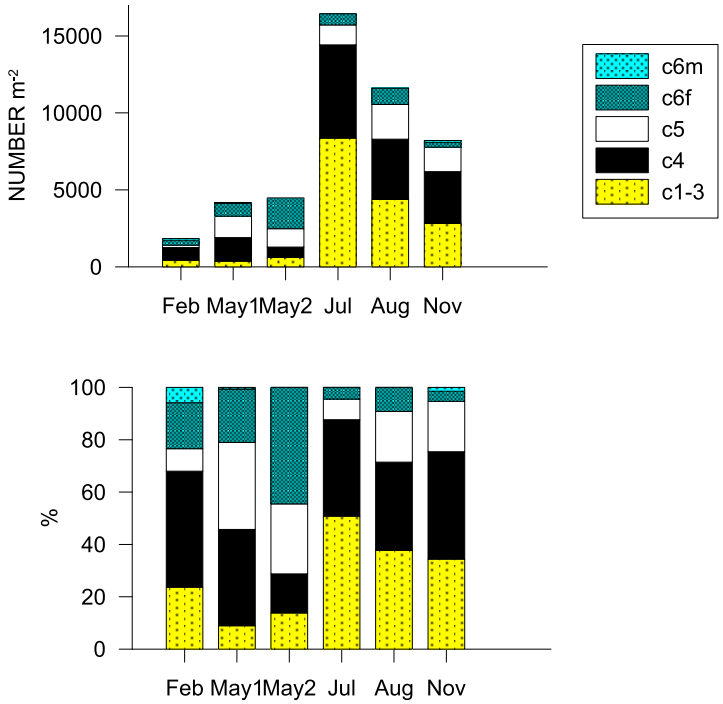
C6f

C6m

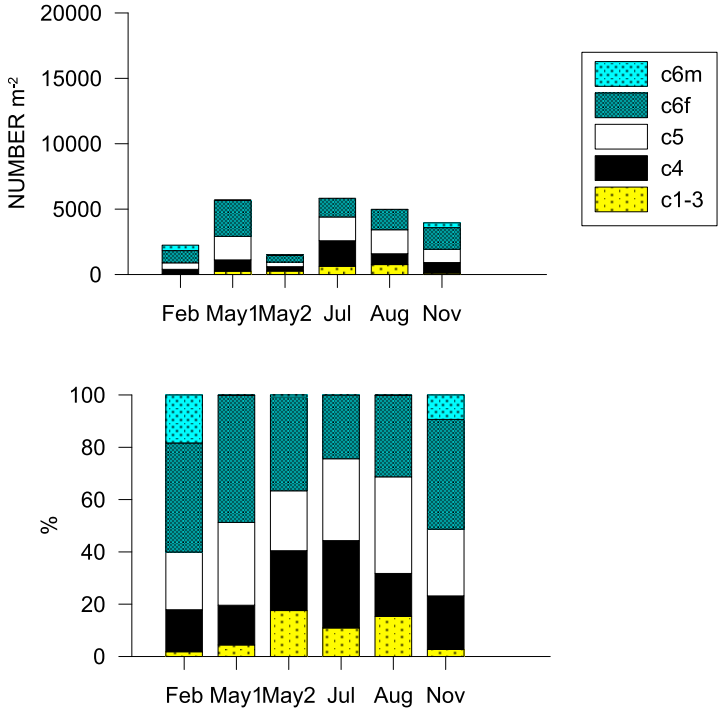


Chyp: Depth integrated abundance (per m^{-2}) North

West of Kolbeinsey Ridge

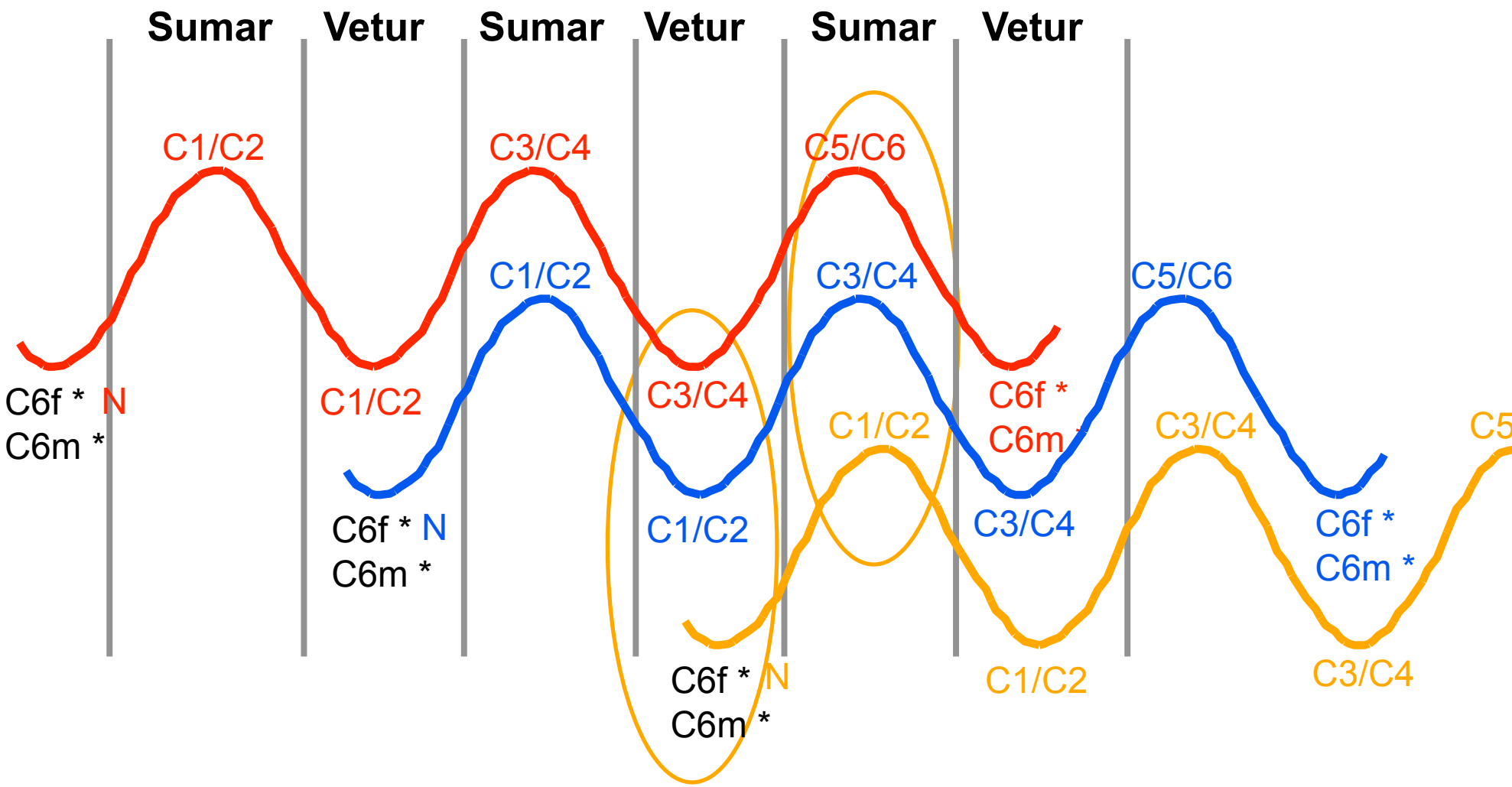


East of Kolbeinsey Ridge

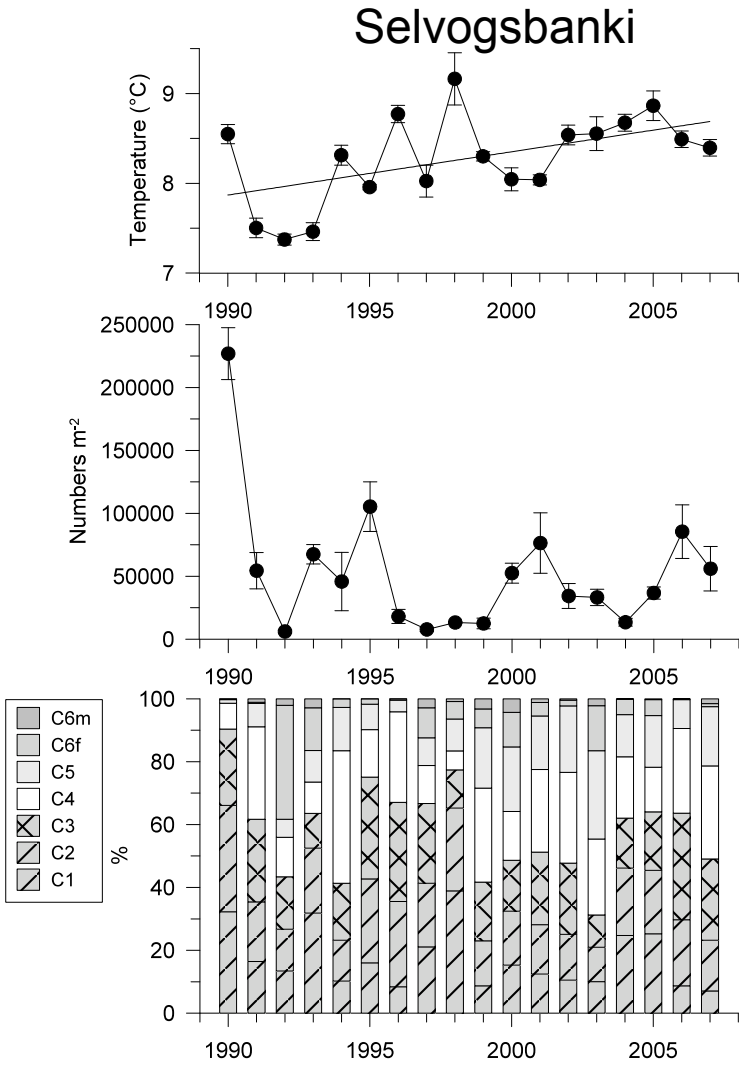


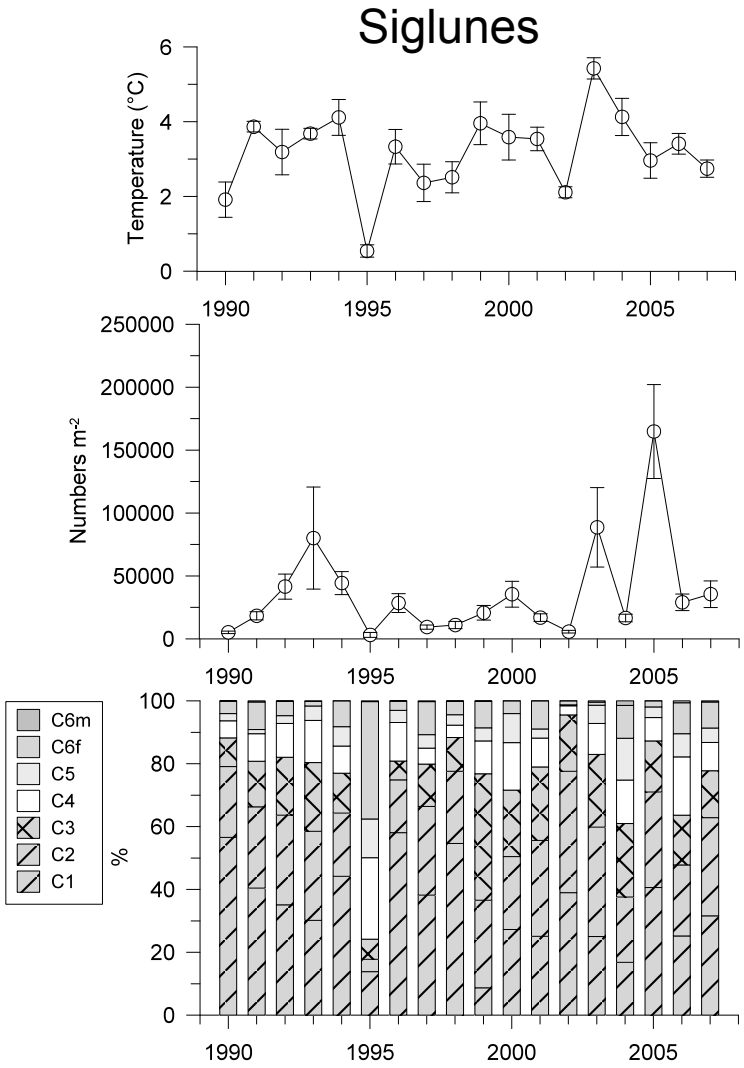
- Males in winter only => mating in winter
- Juveniles (c1-3) year round
- 2-3 year life cycle?

3-year life cycle (Chyp)



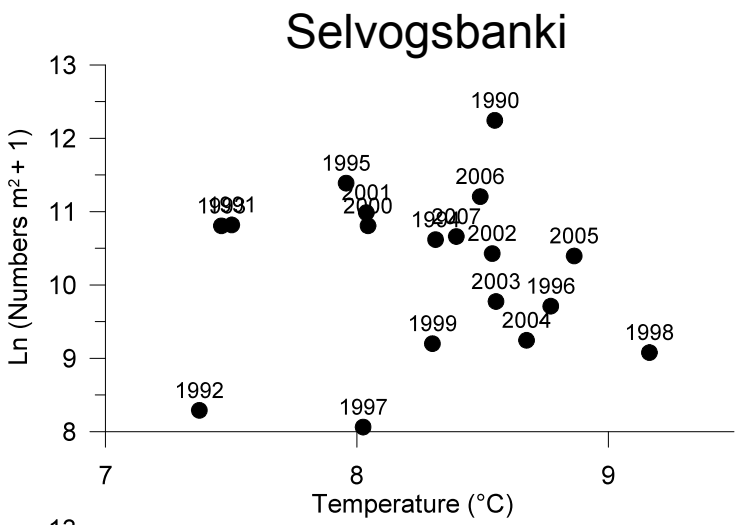
Cfin long-term changes

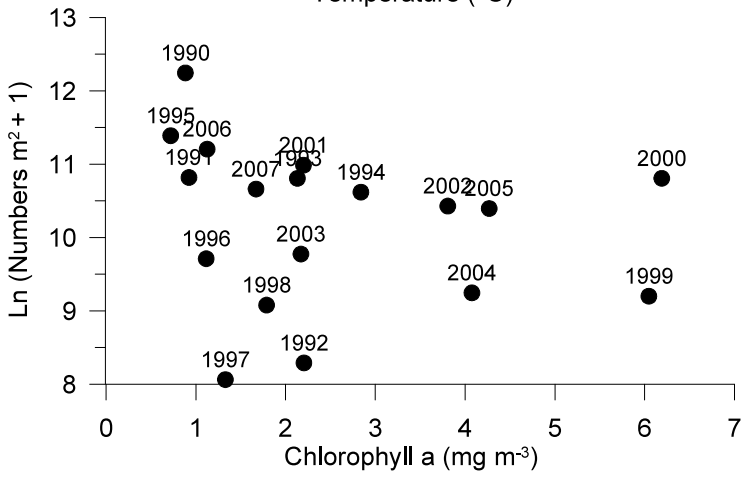


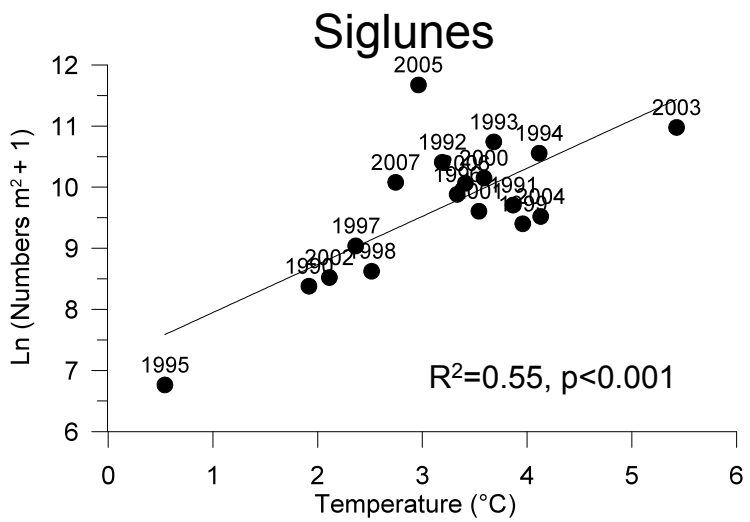


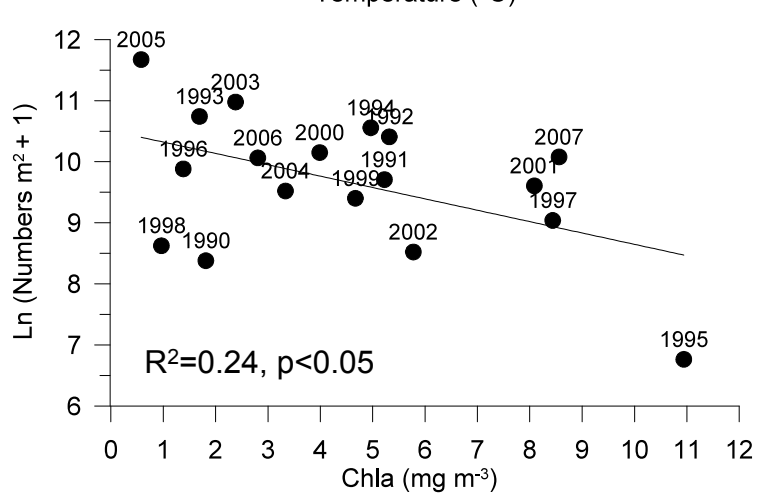
- Long-term variability in north and south not in tune
- Higher proportion of C1-3 in north than south

Cfin abundance v. temp and Chla





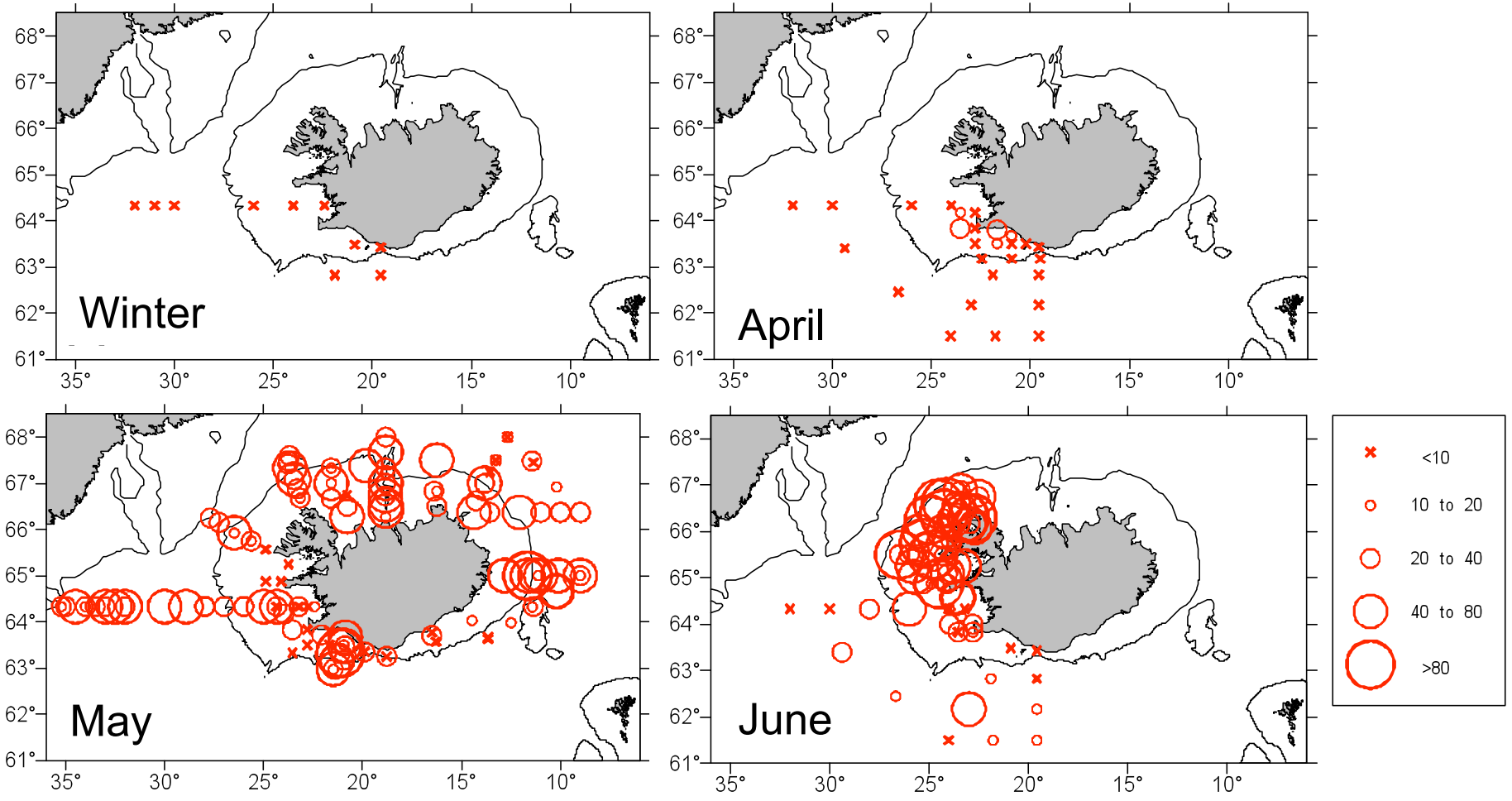




- Effect of temperature: advection from south?
- Zooplankton top-down controlling phytoplankton in north?

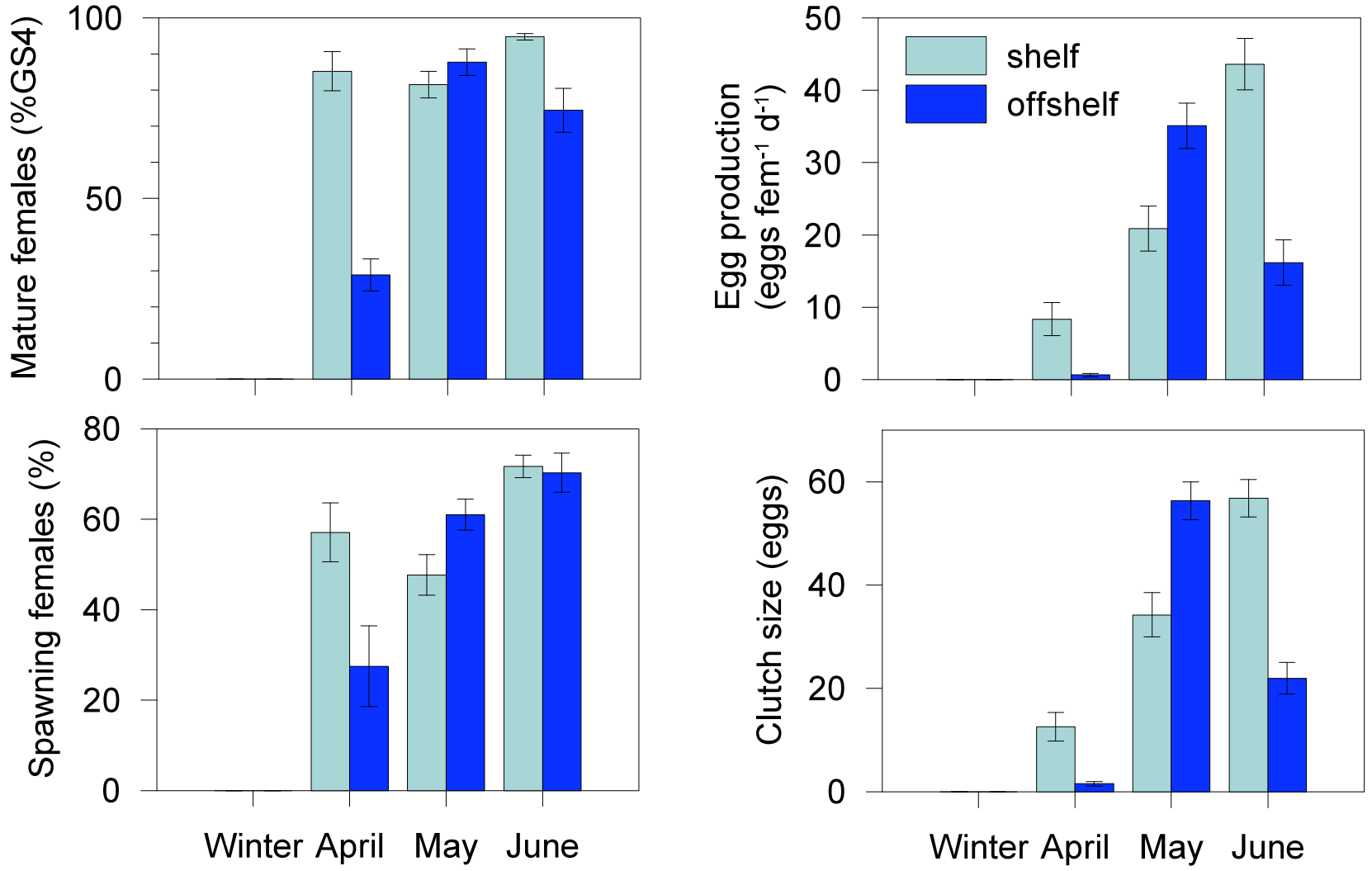
Cfin egg production (eggs female^{-1} day^{-1})

~20 females incubated individually for 24 hours



(Gislason et al. 2005)

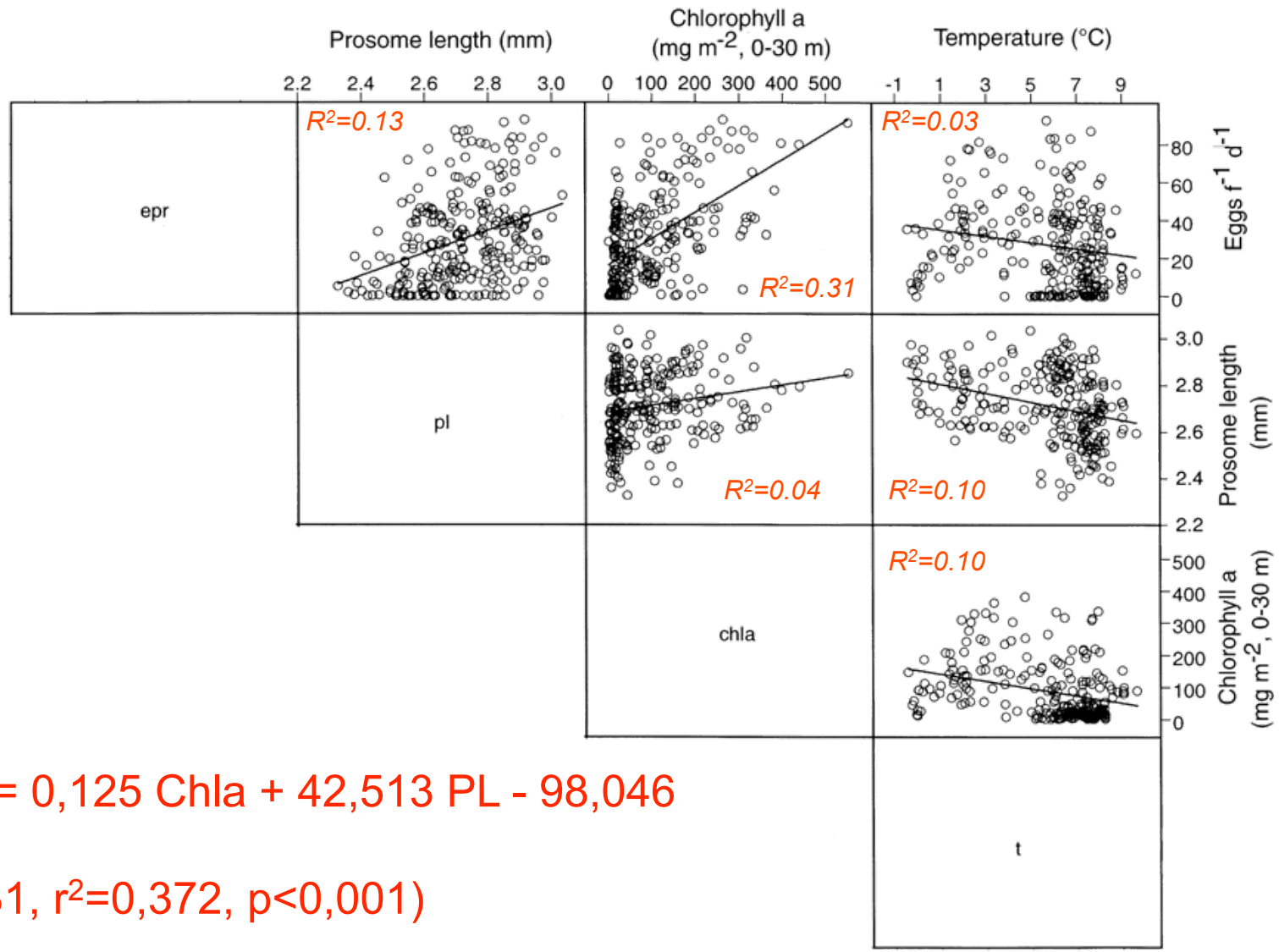
Cfin egg production: Seasonal variability SW



- Productive season starts earlier on-shelf (April) than off-shelf (May)
- Productive season longer on-shelf than off-shelf

(Gislason et al. 2005)

Factors affecting Cfin EPR

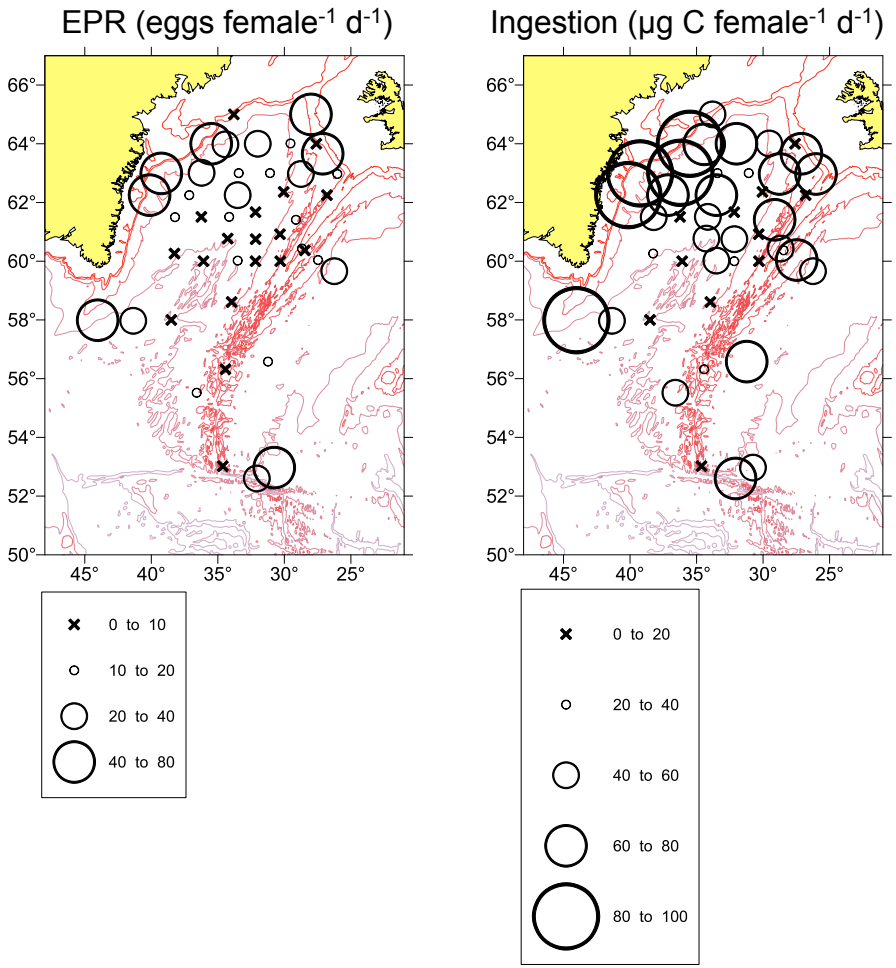


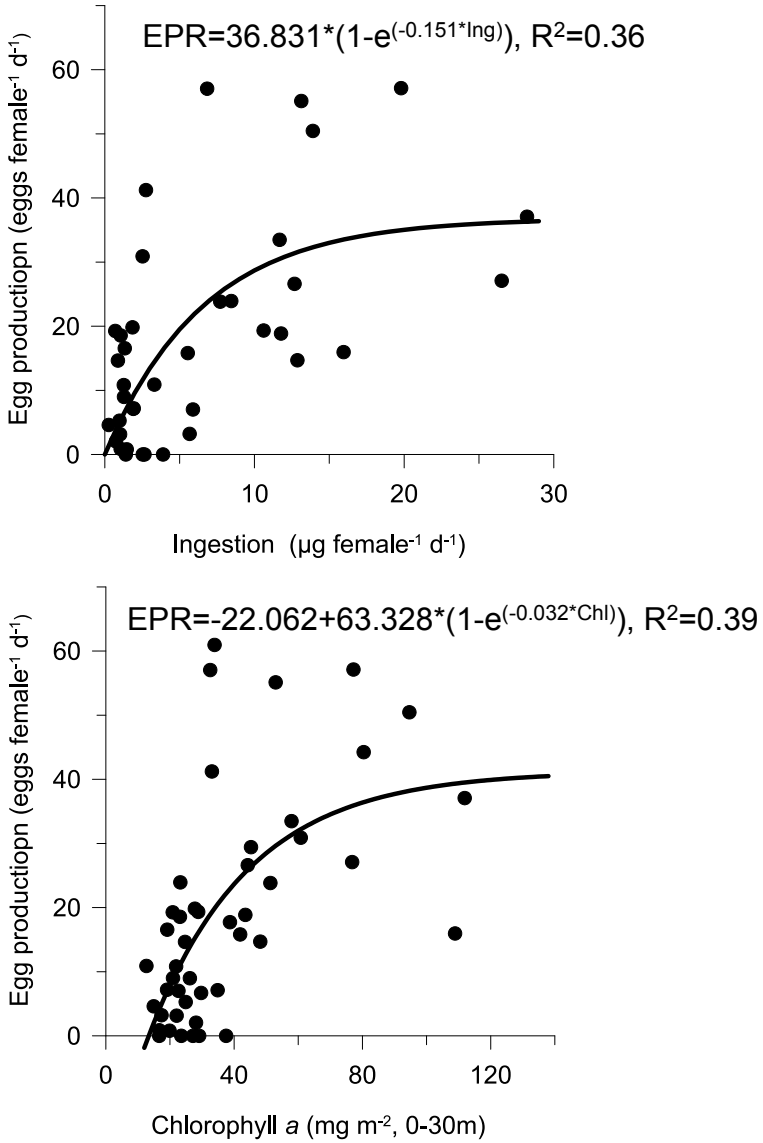
EPR = 0,125 Chla + 42,513 PL - 98,046

(n=231, r^2=0,372, p<0,001)

(Gislason et al. 2005)

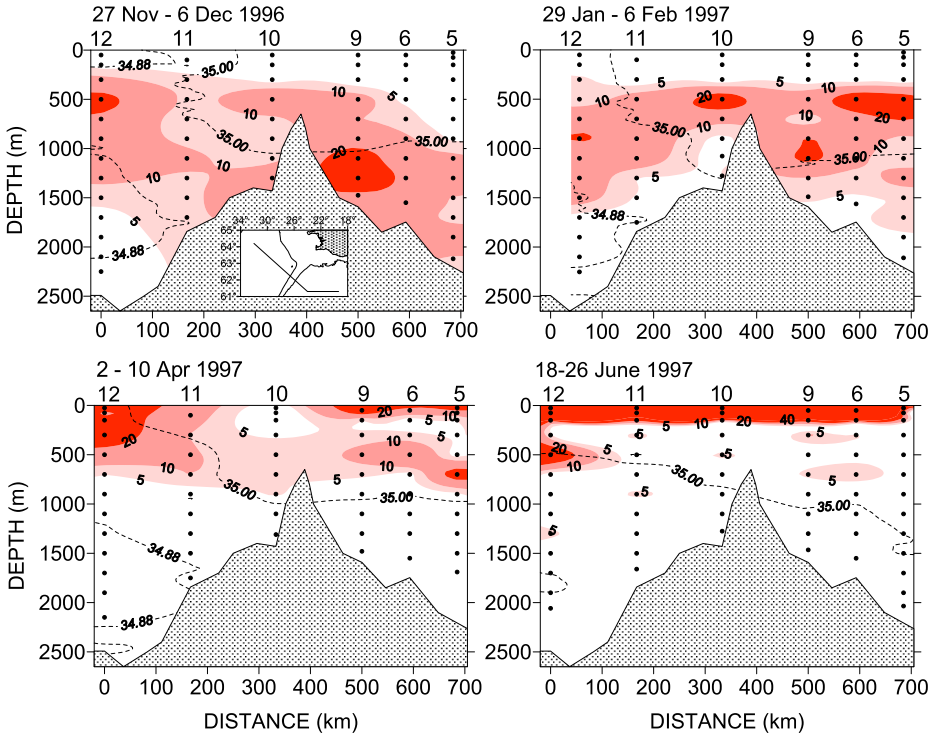
Cfin EP and ingestion rates in Irminger Sea

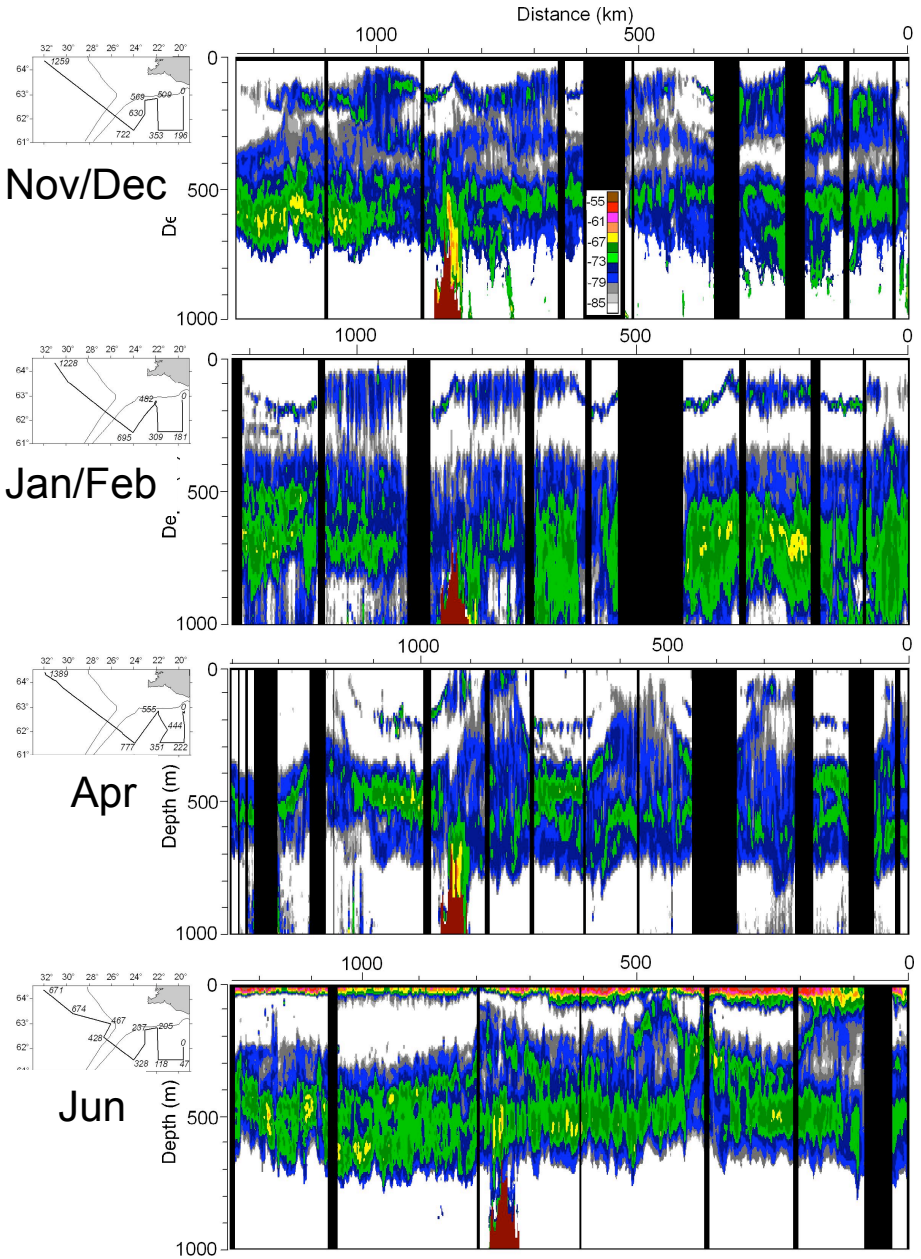




(Gislason et al. 2008)

Calanus and DSLs





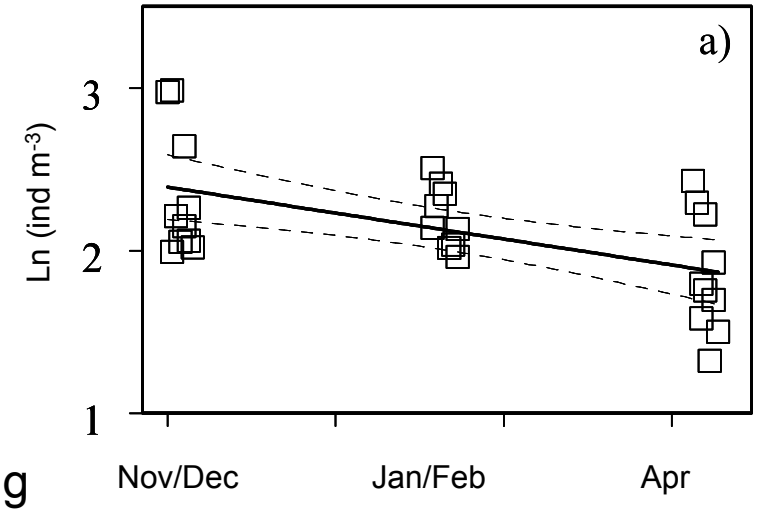
- Significant part of Cfin overwinter below DSLs
- Organisms in DSLs eat *Calanus*
- Ascendance =>migration through predator layers
- Do DSLs affect overwintering distribution?

(Gislason et al. 2007)

Do the DSLs affect survival?

Mortality estimated by …

1. Linear regressions of density estimates
2. Vertical Live Table Method



(Gislason et al. 2007)

Result …
Significant reduction in numbers during the ascent phase (Jan/Feb – April) but NOT during diapause (Nov/Dec - Jan/Feb)

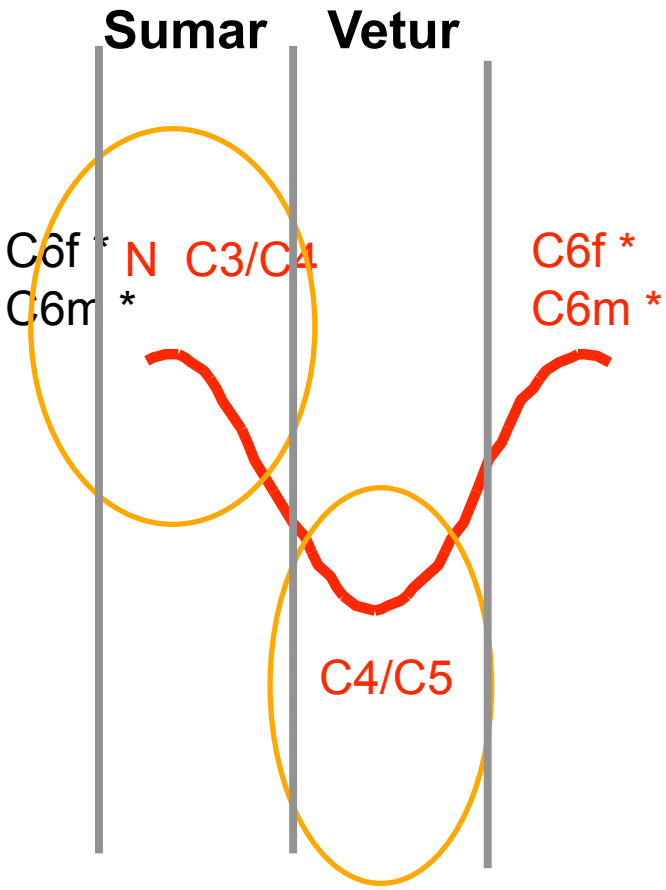
Conclusion:
The predators have an impact on survival during the ascent phase

Estimates of Cfin overwintering mortality:
Iceland and Irminger Basins 0.4% per day (Gislason et al. (2007)
Norwegian fjords 0.8-2.5% per day (Bagöien et al 2001)
Norwegian Sea 0.7-1.3% per day (Bagöien et al. 2001, Östvedt 1955)

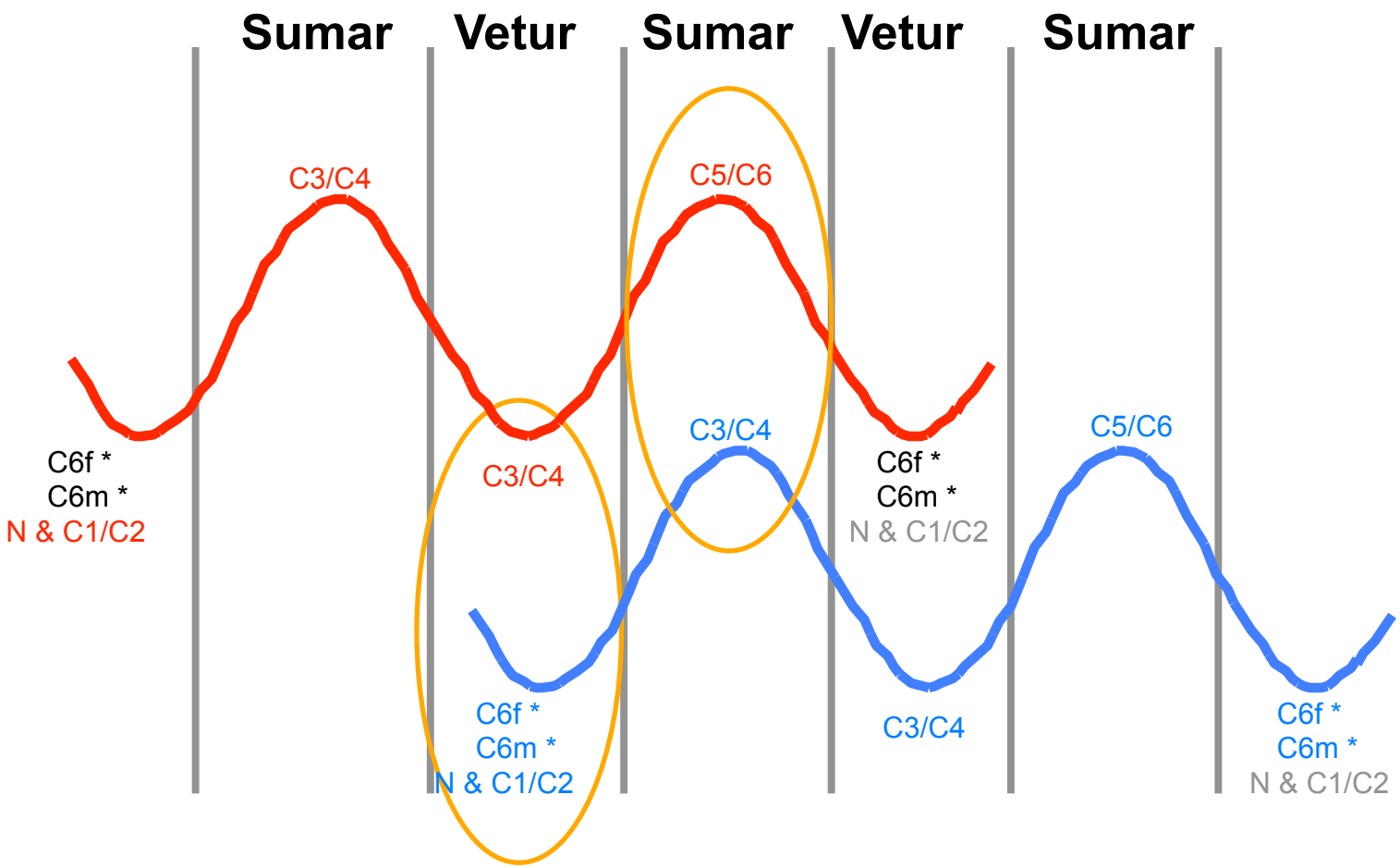
Conclusions

- Cfin stock size greater in Atlantic water than in mixed Atlantic/Arctic or Arctic
- Chyp stock size greatest in Atlantic/Arctic or Arctic
- Cfin overwinter at greater depths and at higher temperatures in south (~400-2000m, ~3-6°C) than north (~200-1000, ~0°C)
- North: Chyp overwinters deeper than Cfin
- Cfin stay longer (May-August) in surface waters than Chyp (May-July)
- Cfin: main spawning in April-May/June
- Chyp: Mating in winter – 2-3-year life cycle?
- Long-term variability of Cfin in north and south not in tune
- In north ~55% of long-term variability in Cfin abundance may be explained by temperature
- Cfin: EPR mainly a function of Chla and female size
- Cfin: Low mortality during overwintering

Eins árs lífsferill (rauðáta)

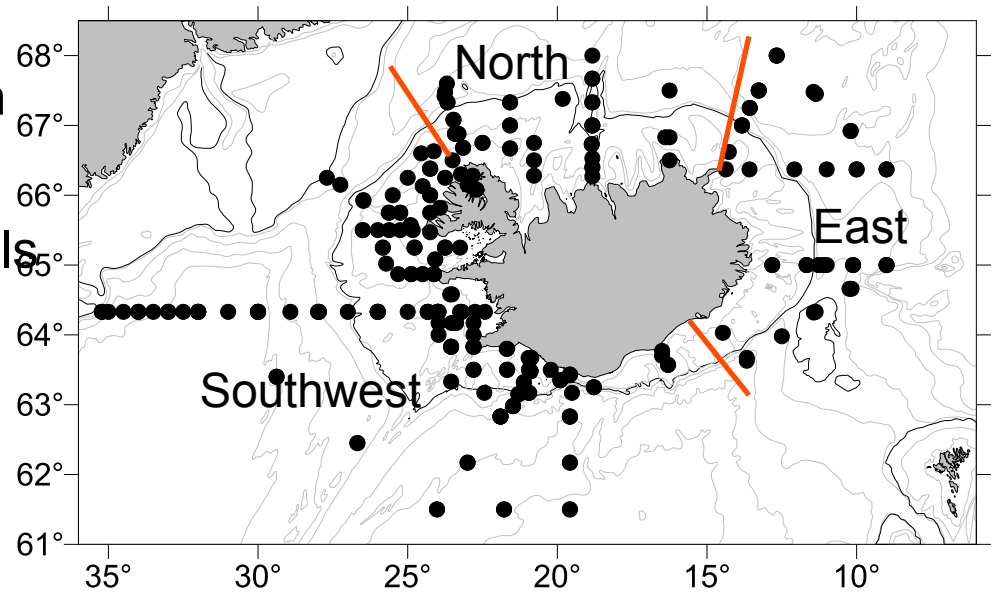


Tveggja ára lífsferill (póláta)



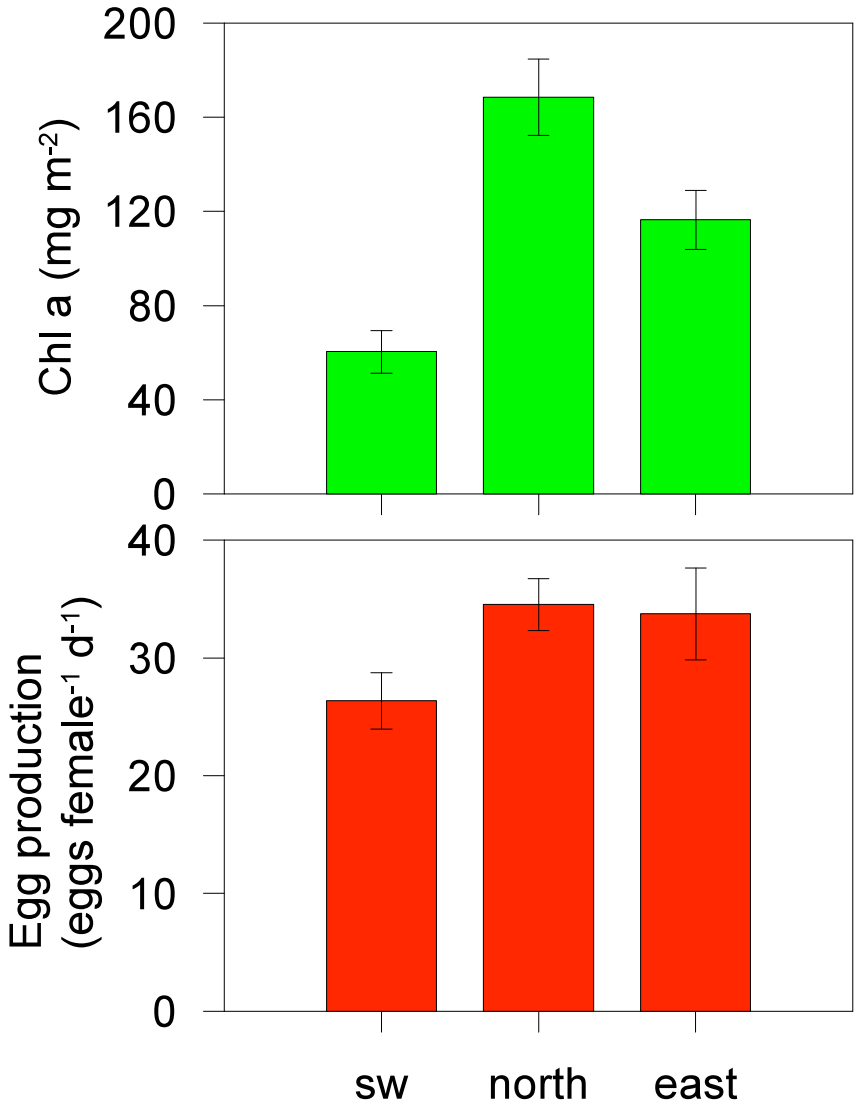
Egg production rates - data

- 13 cruises (1996-2002)
- Hydrography & phytoplankton
- Net tows for abundance
- Incubations with single animals (~ 20 experiments/station)



	Southwest	North	East
Winter (Nov-Feb)	12 (48)		
April	27 (349)		
May	70 (1192)	38 (601)	42 (72)
June	72 (1284)	4 (76)	

Egg production: Spatial variability May



(Gislason et al. 2005)