Calanus helgolandicus ecology in European waters: data availablity and data gaps

Delphine Bonnet
Université Montpellier II
and
Roger Harris
Plymouth Marine Laboratory

Outline:

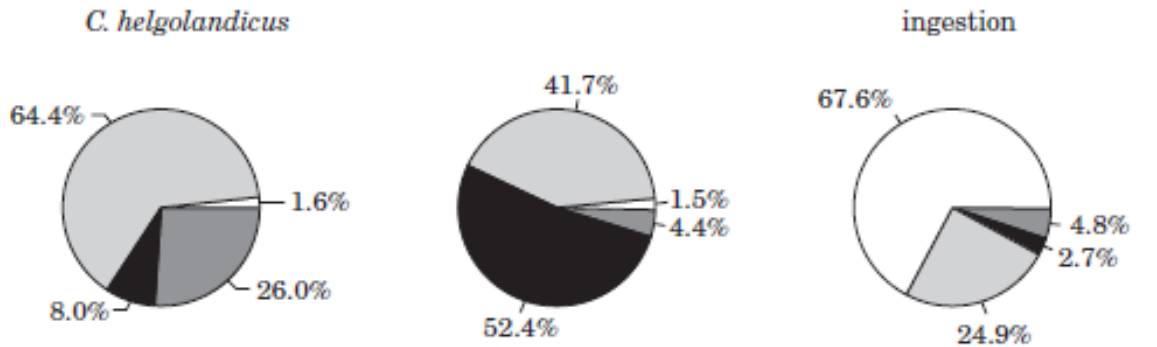
- diet
- distribution
- length - weight data,
- diapausing strategy
- mortality
- development and growth
- demography
- reproduction

Reviewing what is know about *C.helgolandicus*, some comparisons with *C.finmarchicus*, and identifying data gaps and areas for further work

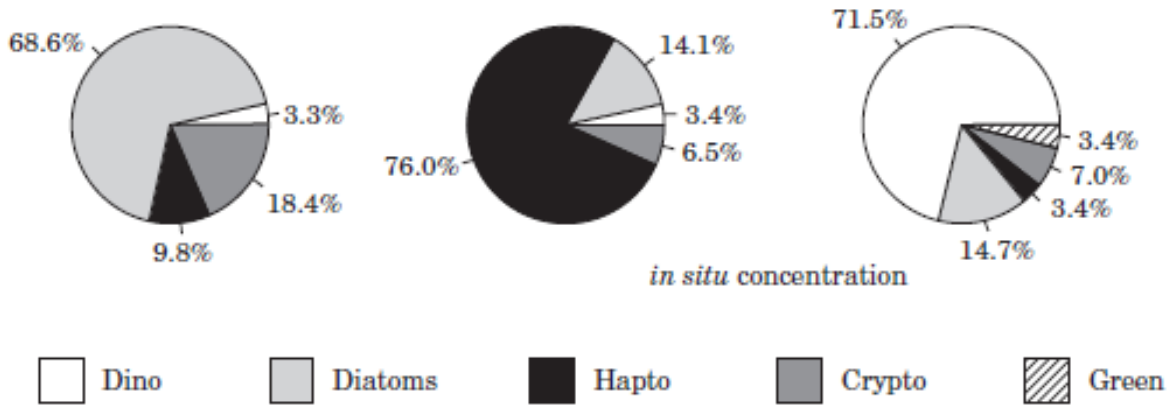
Diet and ingestion

DIET IN THE ENGLISH CHANNEL

Adult female diet



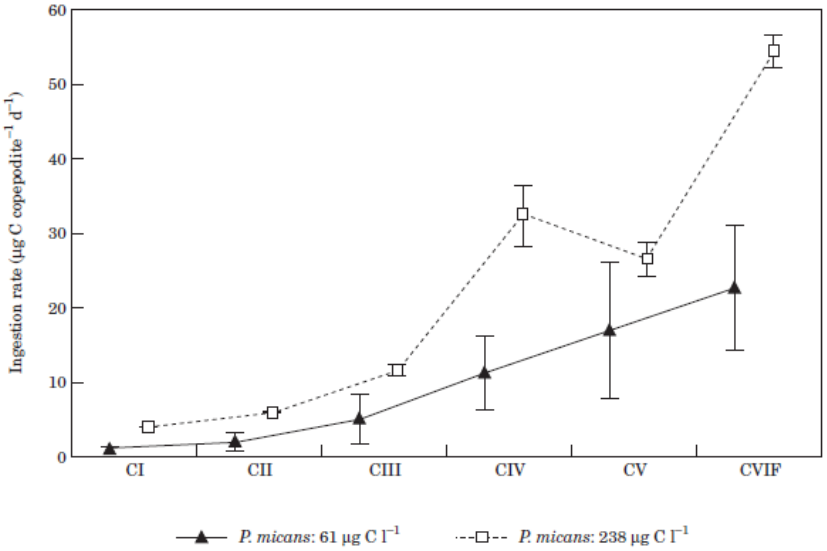
In situ phytplankton



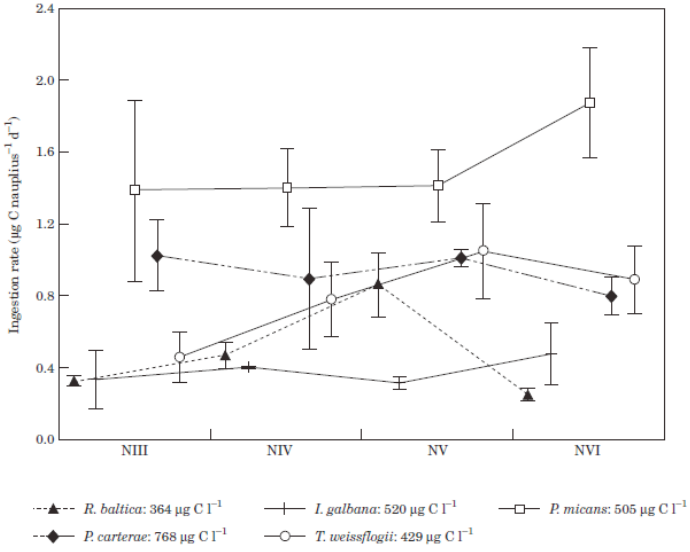
Harris et al. (2000) ICES JMS

Diet and ingestion

INGESTION RATES IN LABORATORY CULTURES



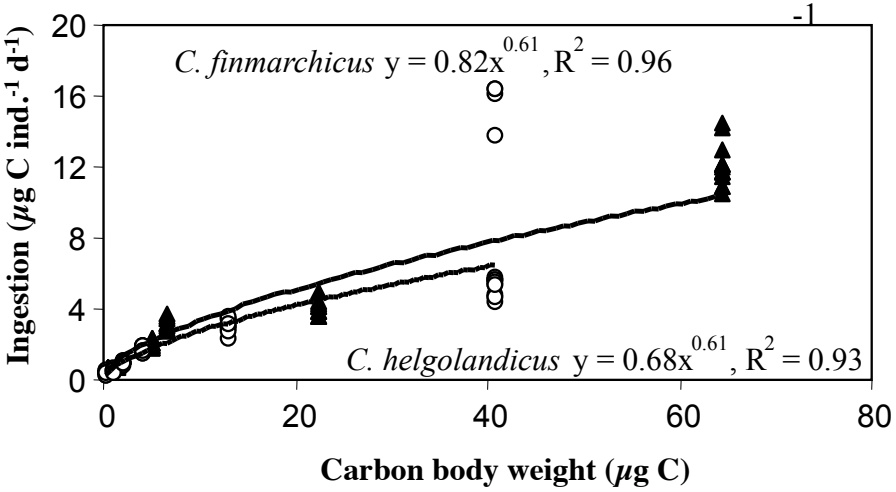
Copepodites

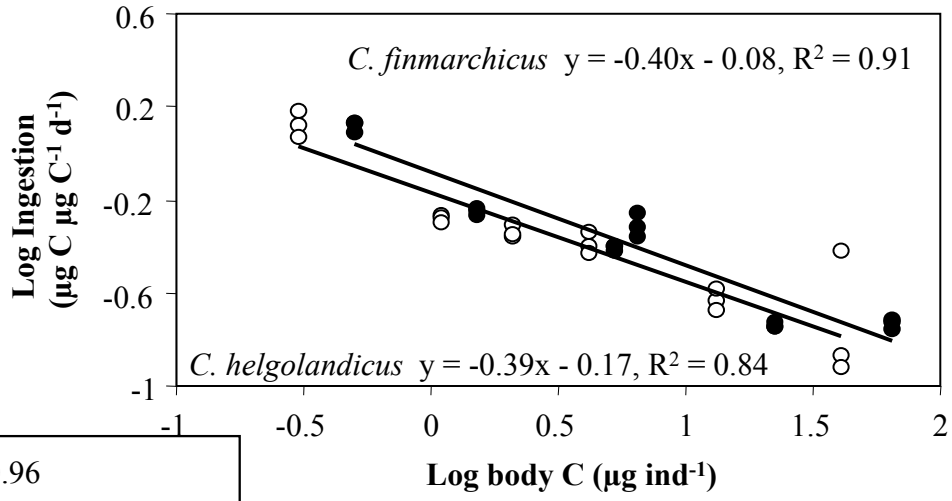


Nauplii

Harris et al. (2000) ICES JMS

COMPARISON of *C.helgolandicus* and *C.finmarchicus* ingestion rates





Diet Data Gaps:

Role of microzooplankton?

Natural in situ diet?

Does diet affect distribution/ seasonality?

Meyer et al., (2002)

Distribution

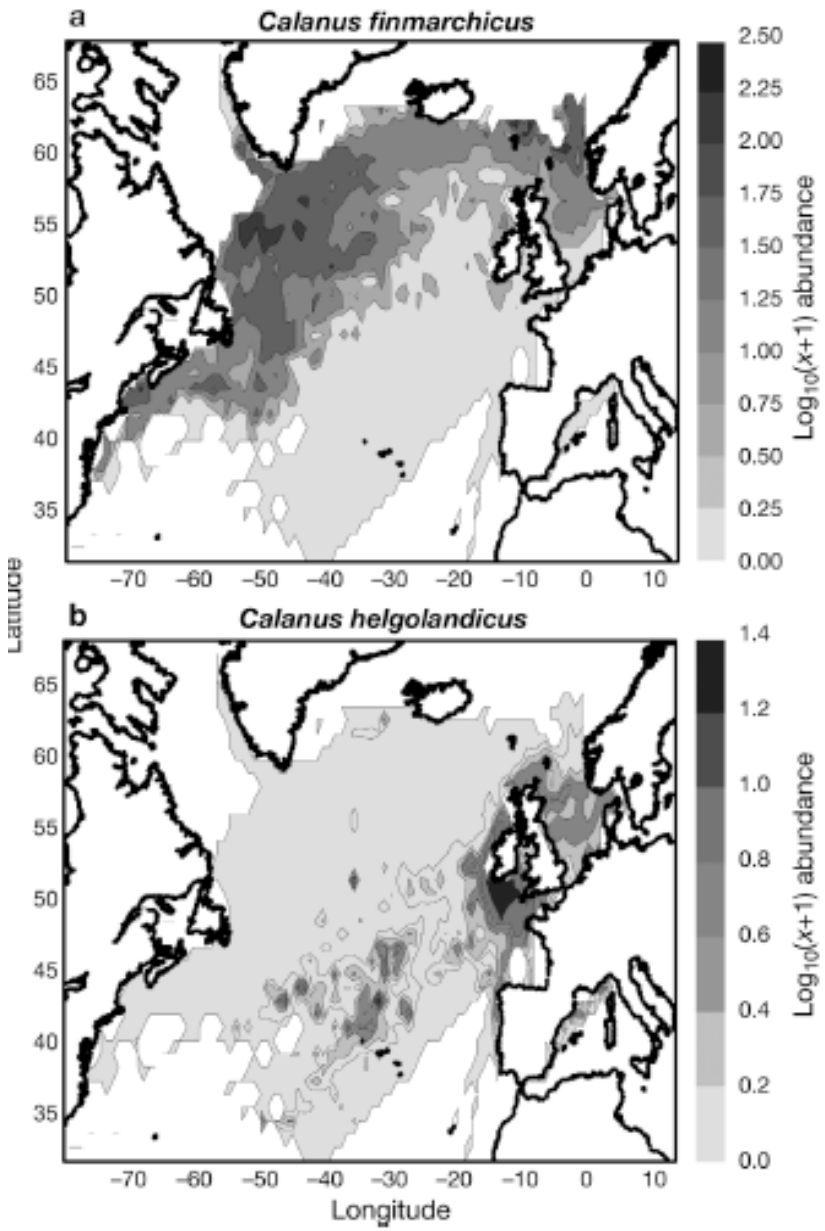


Fig. 3. (a) *Calanus finmarchicus* and (b) *C. helgolandicus*. Spatial distribution in North Atlantic Ocean. No interpolation made

DISTRIBUTION OF BOTH SPECIES-

CPR DATA

Helaouet and Beagrand (2007)

Distribution

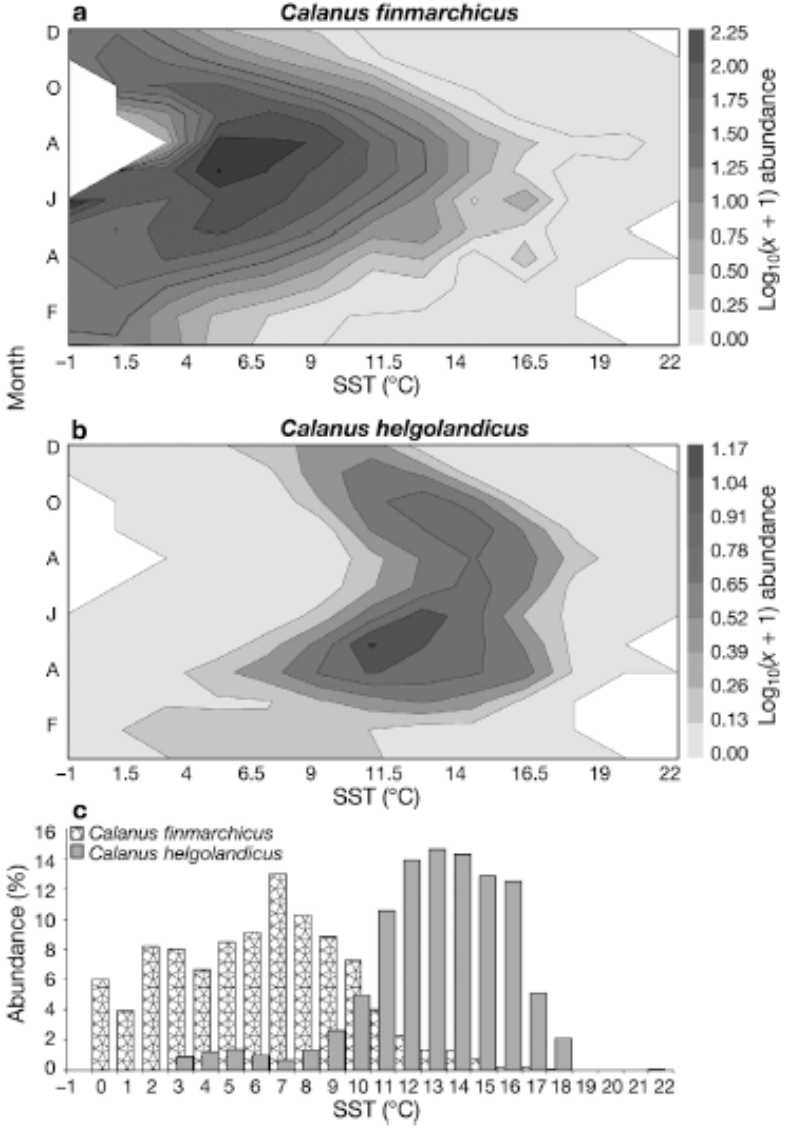


Fig. 5. *Calanus finmarchicus* and *C. helgolandicus*. (a,b) Contour diagram of abundance (decimal logarithm) as a function of SST and month of year, and (c) histogram showing percent relative average abundance as a function of SST

NICHES OF THE TWO SPECIES COMPARED

Helaouet and Beagrand (2007)

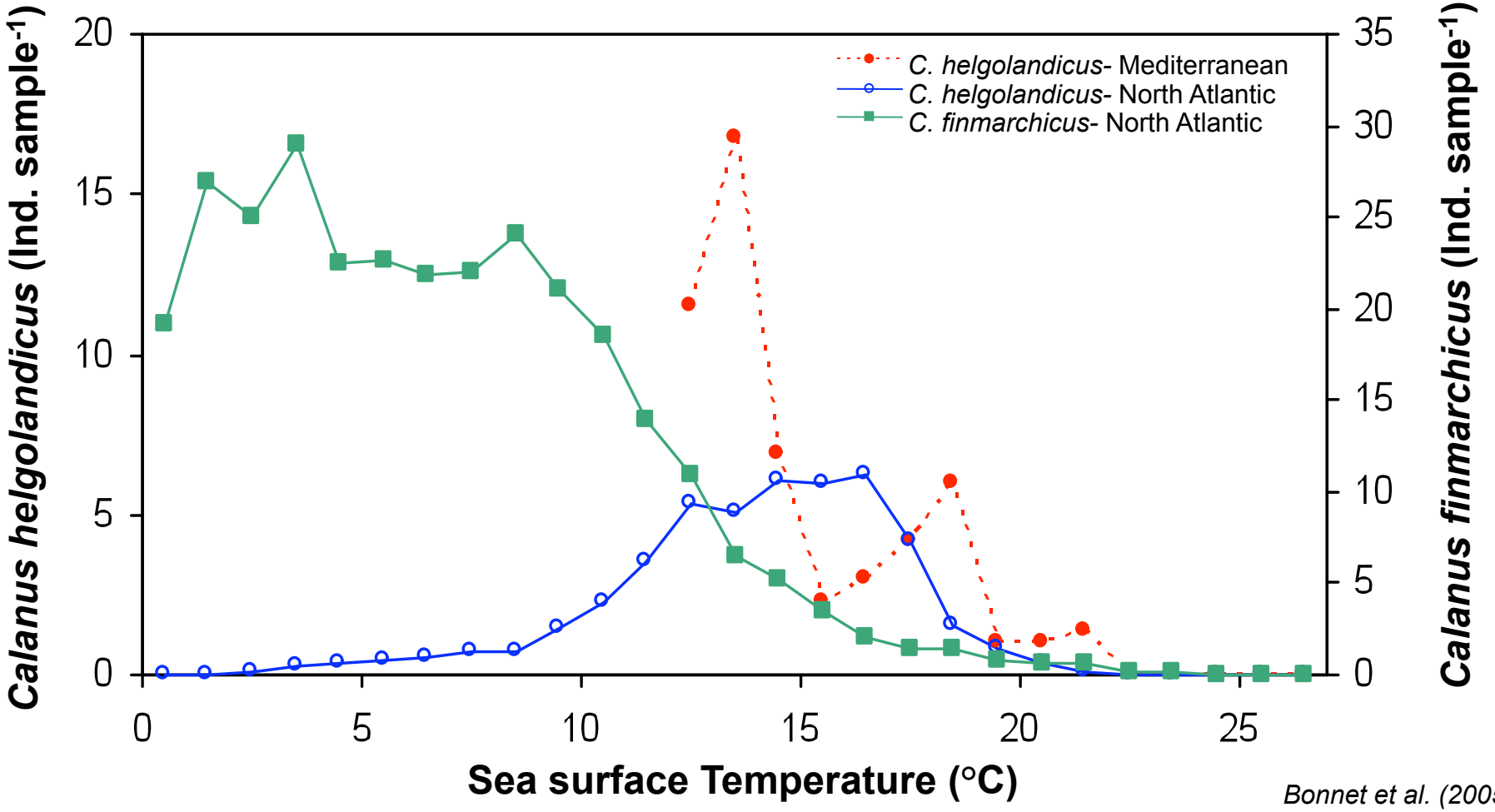
Distribution

Thermal niche of

-*Calanus finmarchicus* in the Altlantic/ North Sea

-*Calanus helgolandicus* in the Mediterranean and in the Atlantic/ North Sea

from the CPR samples

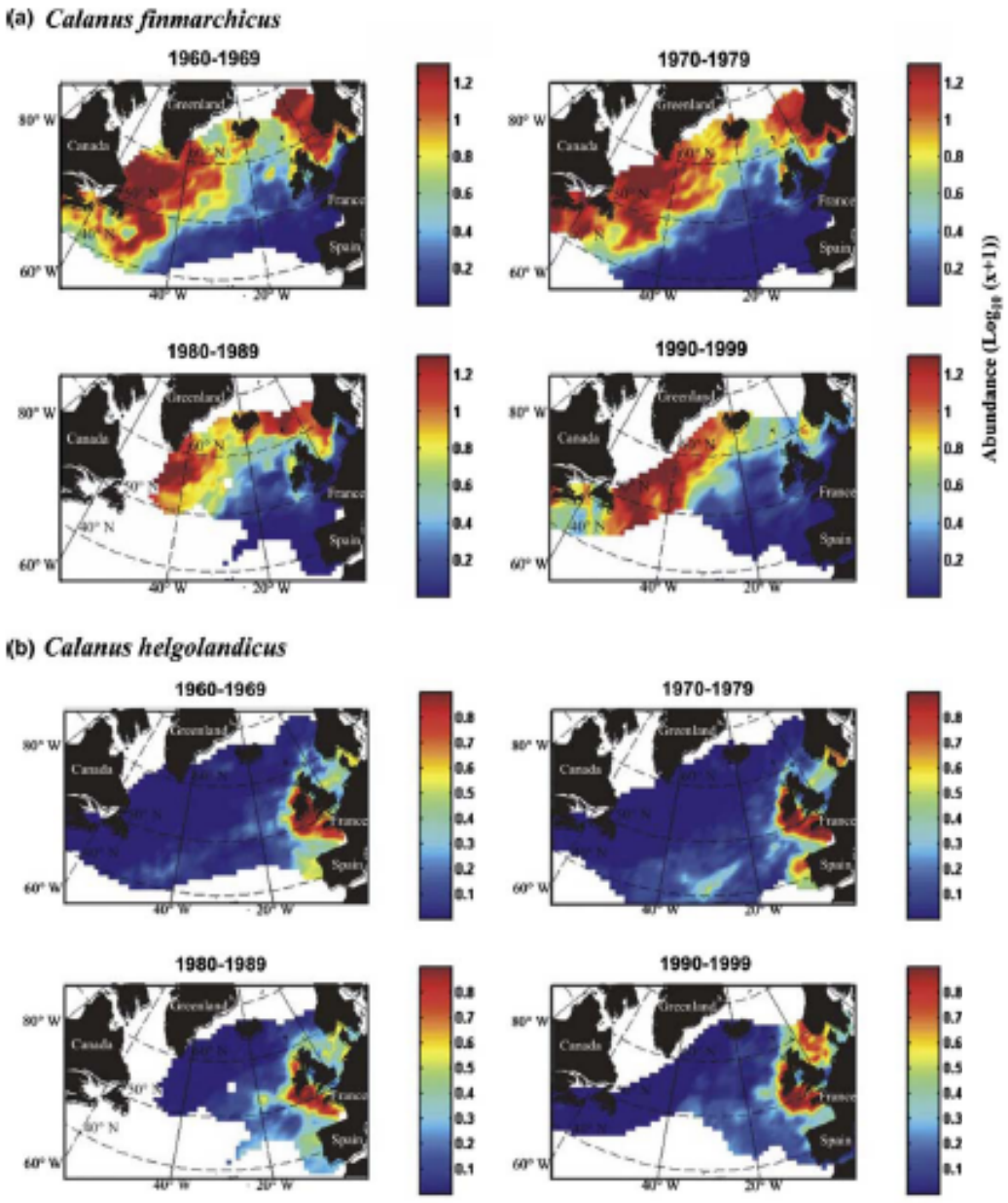


Bonnet et al. (2005)

Bonnet et al. (2010)

Distribution

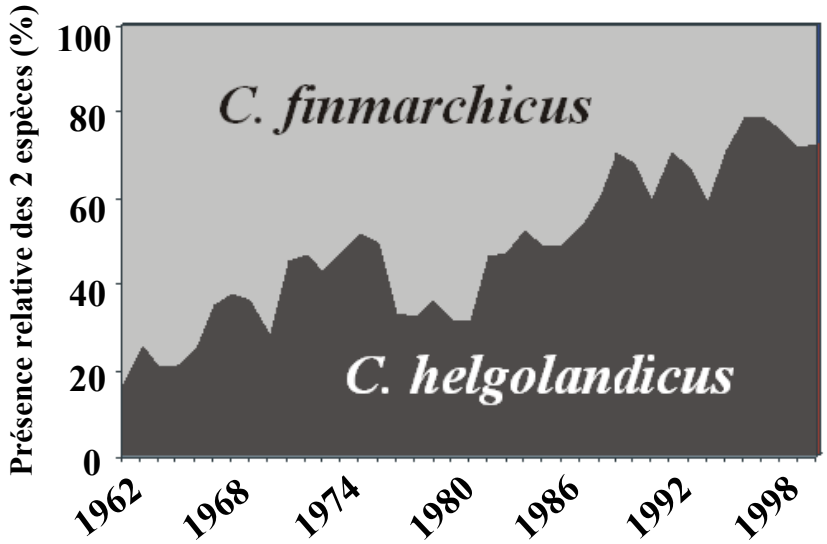
NORTHERLY RANGE EXTENSION ON THE EASTERN SIDE OF THE ATLANTIC



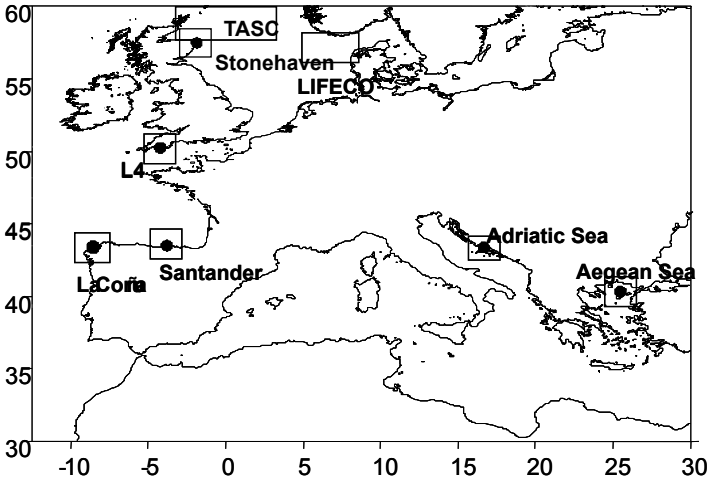
Distribution Data Gaps:

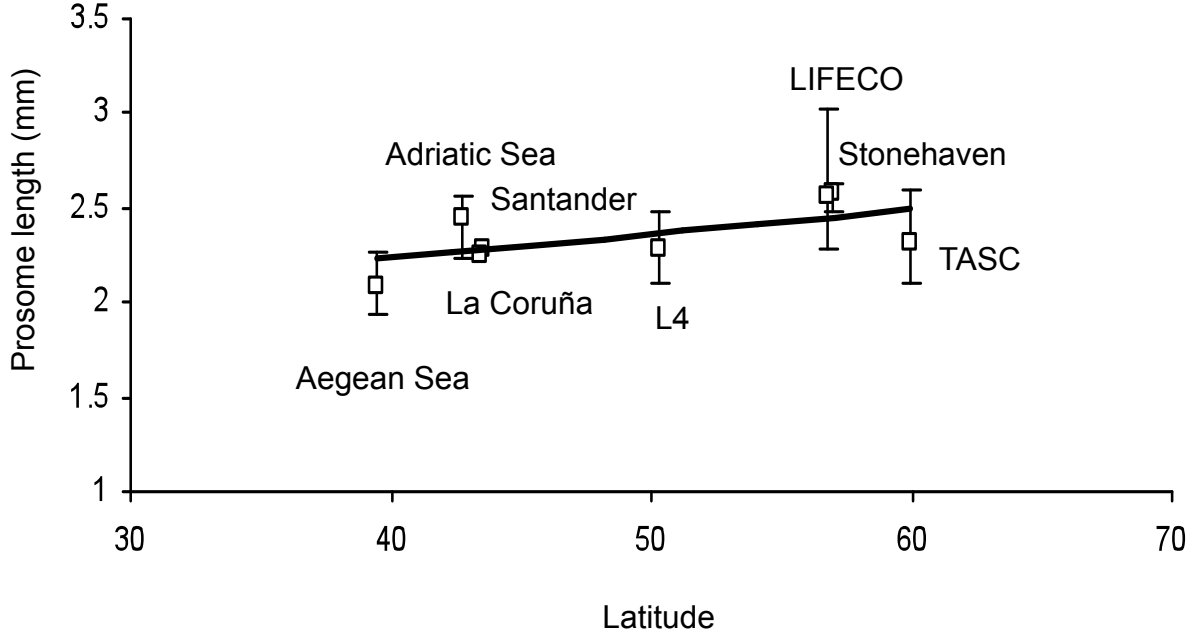
Does C.helgo occur in the NW Atlantic?

Will it become more common with rising temperature?



LATITUDINAL CHANGES IN BODY LENGTH



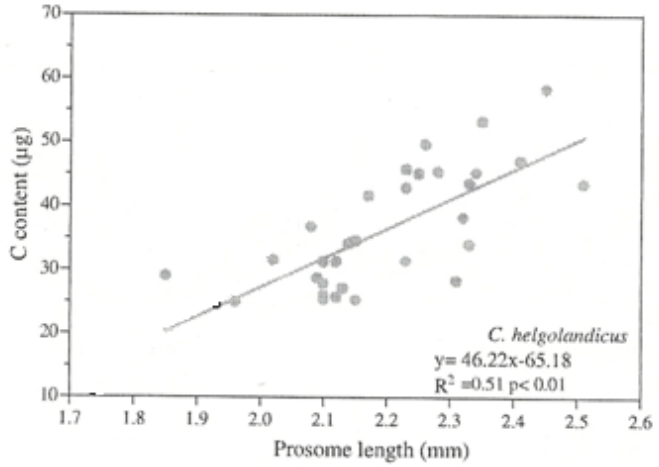


LATITUDINAL AND SEASONAL CHANGES IN BODY LENGTH

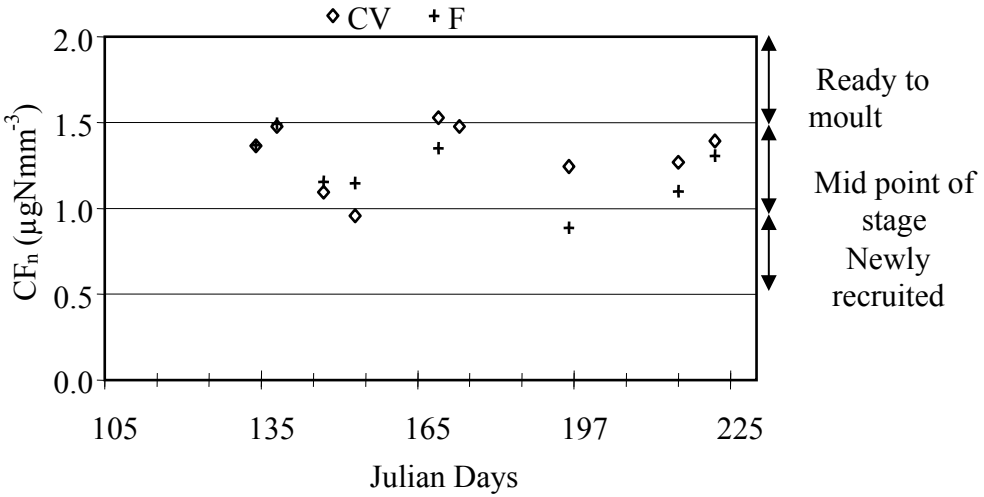
	Northern North Sea (Stonehaven)	English Channel (L4)	Celtic Sea	Southern Bay of Biscay
January	-	94.82	86.90	92.11
February	-	97.69	89.29	95.03
March	-	102.82	93.25	102.05
April	116.73	106.91	-	104.53
May	114.33	108.92	111.11	100.15
June	100	100	100	100
July	102.51	98.71	-	95.03
August	105.86	94.01	96.43	92.69
September	107.69	87.83	-	92.98
October	103.51	93.36	95.24	95.91
November	103.86	90.02	-	92.11
December	-	92.24	-	90.06
Data sets references	Hay et al. (unpublished data)	Bonnet et al. (unpublished data)	Bottrell and Robins (1984)	Ceballos and Álvarez-Marqués (2006)

Seasonal variation in percentage (%) of the prosome length of *Calanus helgolandicus* females at several locations standardised to June data. -: no data

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR

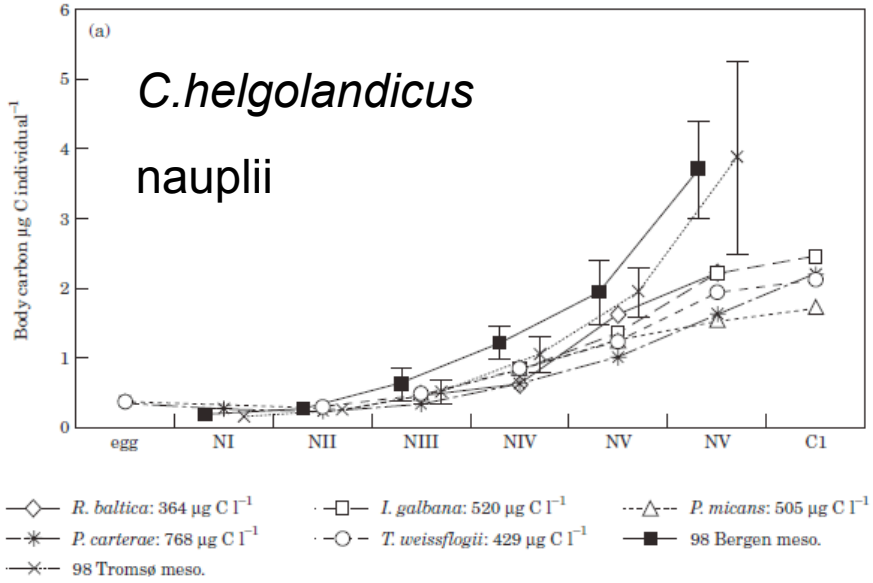


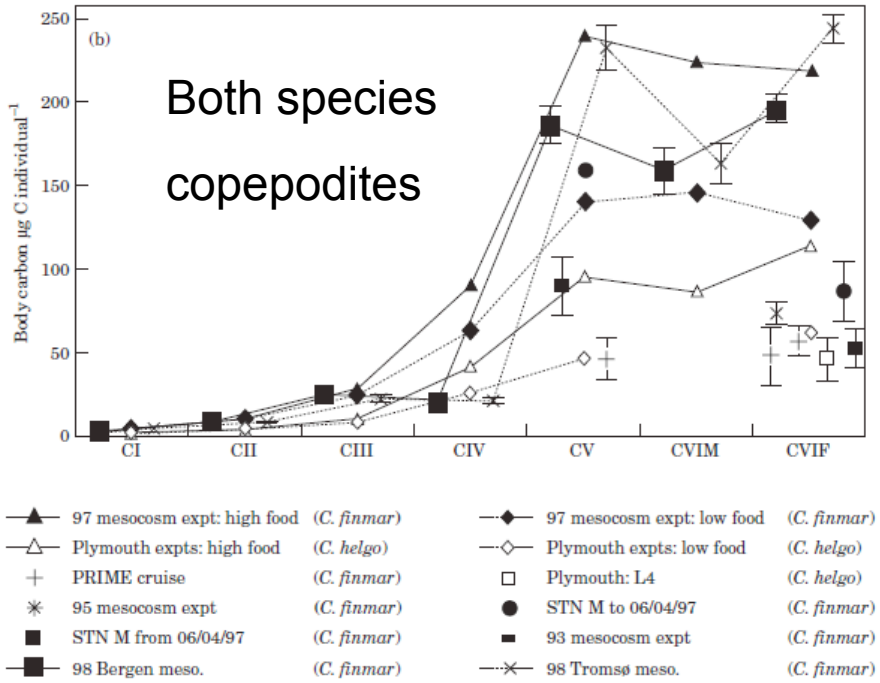
Ceballos et al. (2006)



Rey-Rassat et al. (2004)

Length-weight



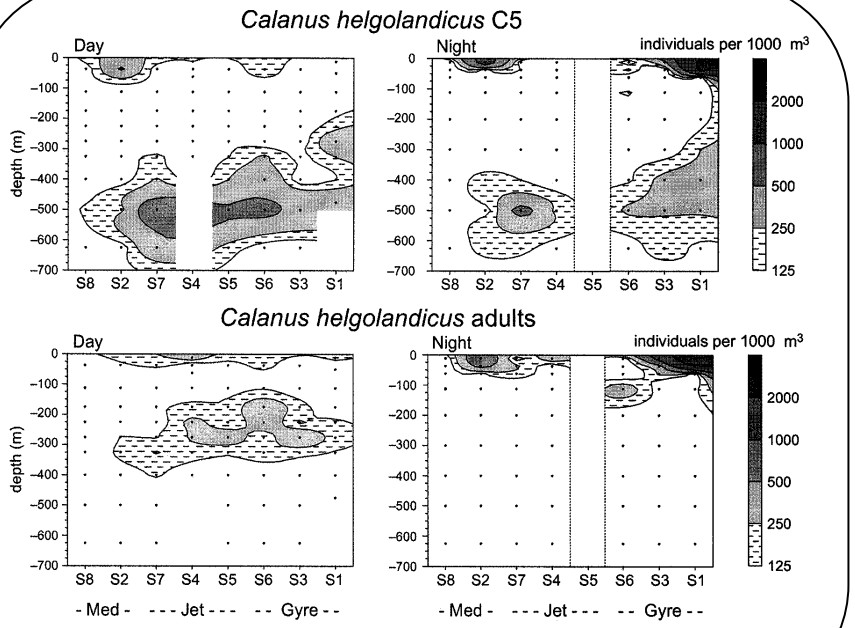


BODY CARBON

Body size Data Gaps:

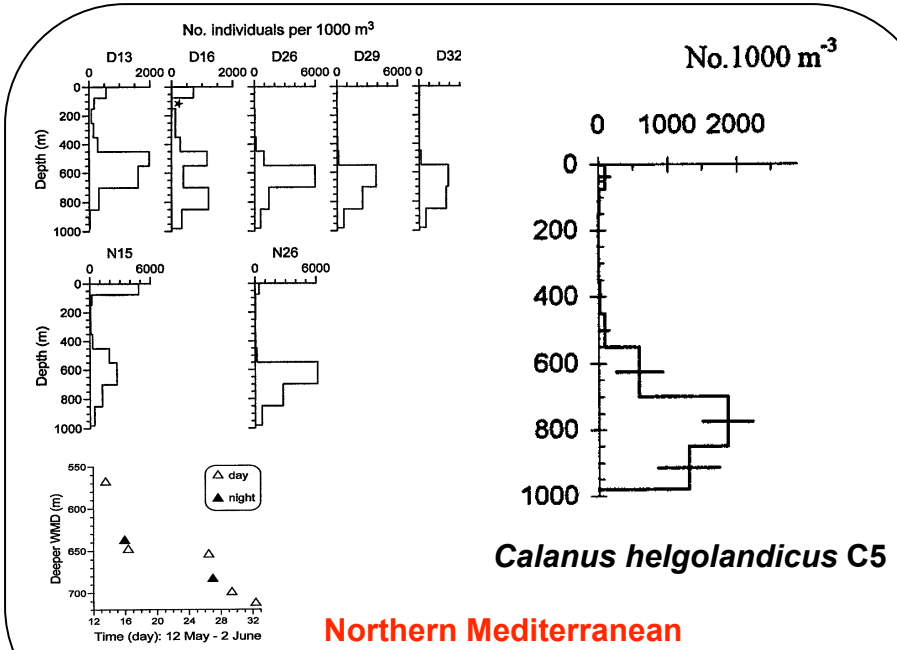
Construct data-base with all body size/ carbon information?

Diapausing strategy



Alboran Sea- Dec 1997/Jan 1998

Andersen et al (2004)



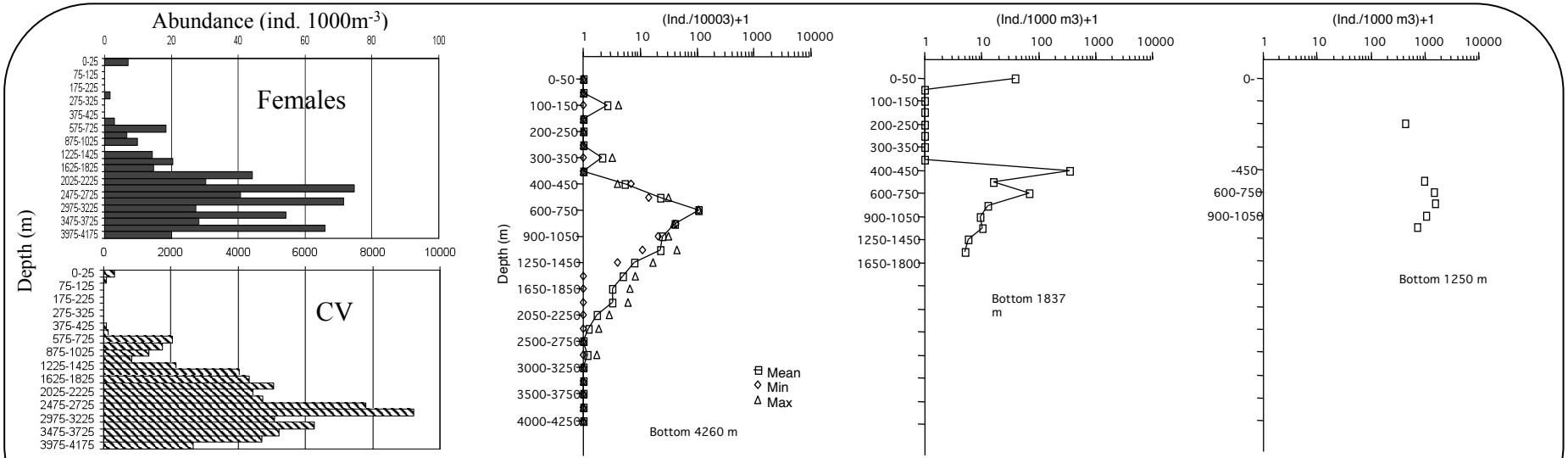
Northern Mediterranean

May-June 1995

Andersen et al (2001)

June 1991

Gasser et al (1998)



Levantine Sea- June 1993

Levantine Sea- Jan 98

Cretan Sea- Jan 98

Aegean Sea- Jan 98

Bonnet et al (2005)- Data Horst Weikert

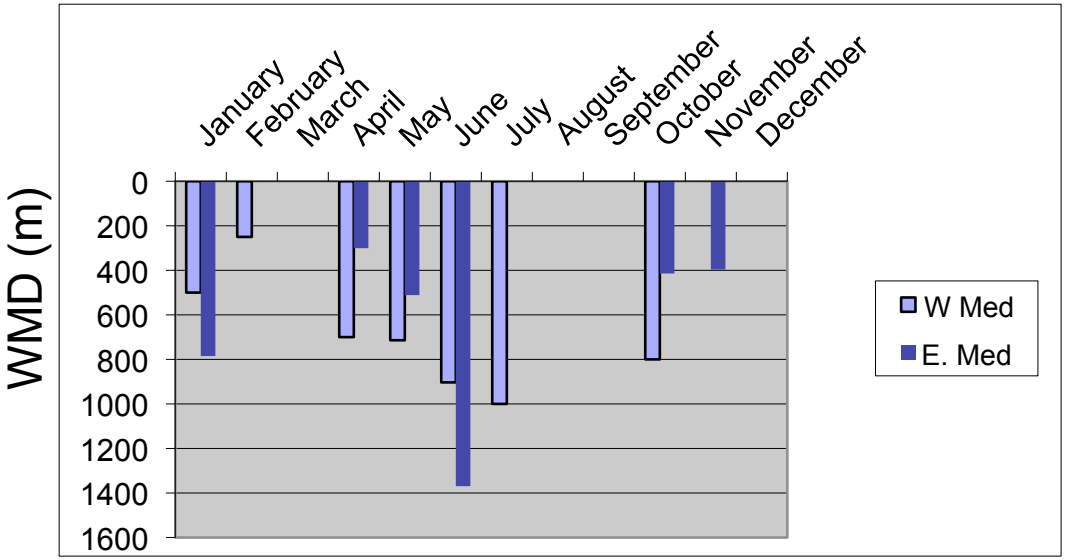
Diapausing strategy

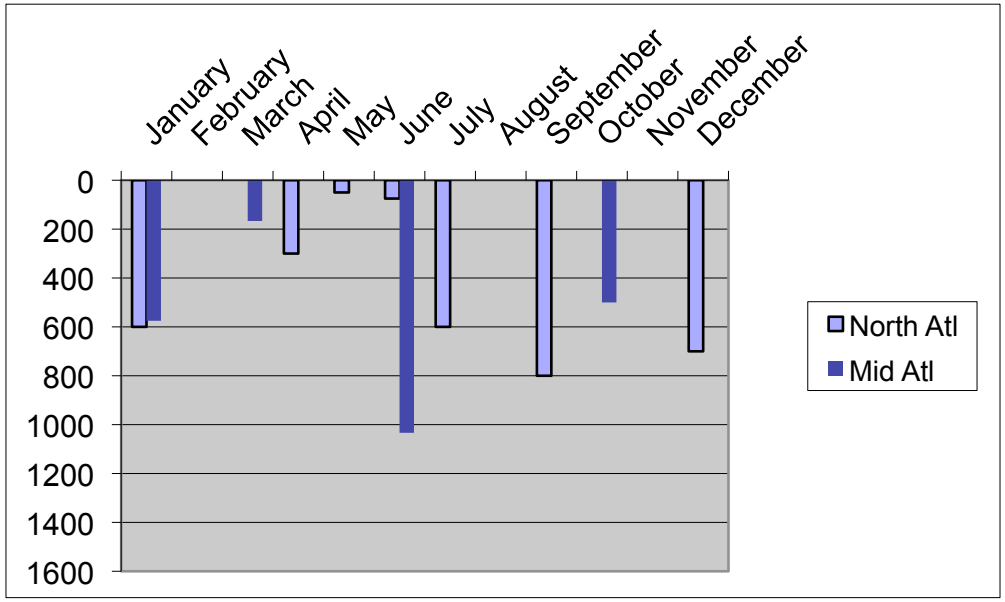
***Published papers on**

***C. helgolandicus*:**

-Vertical distribution: in the Med (8), in the Atlantic (11)

-Diapause: in the Med (0), in the Atlantic (2)



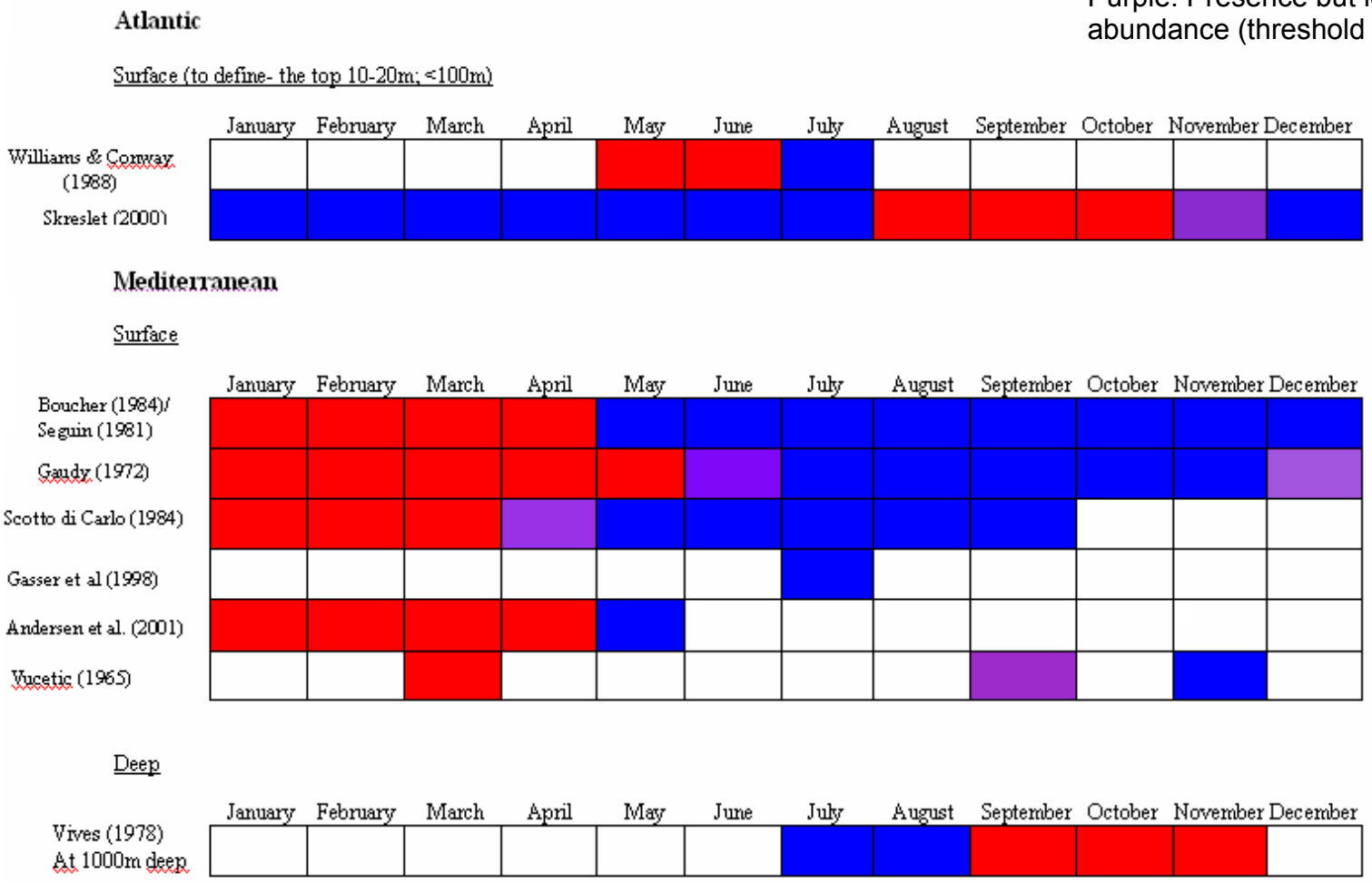


Stage CV (mostly) *C.helgolandicus*

(Own database)

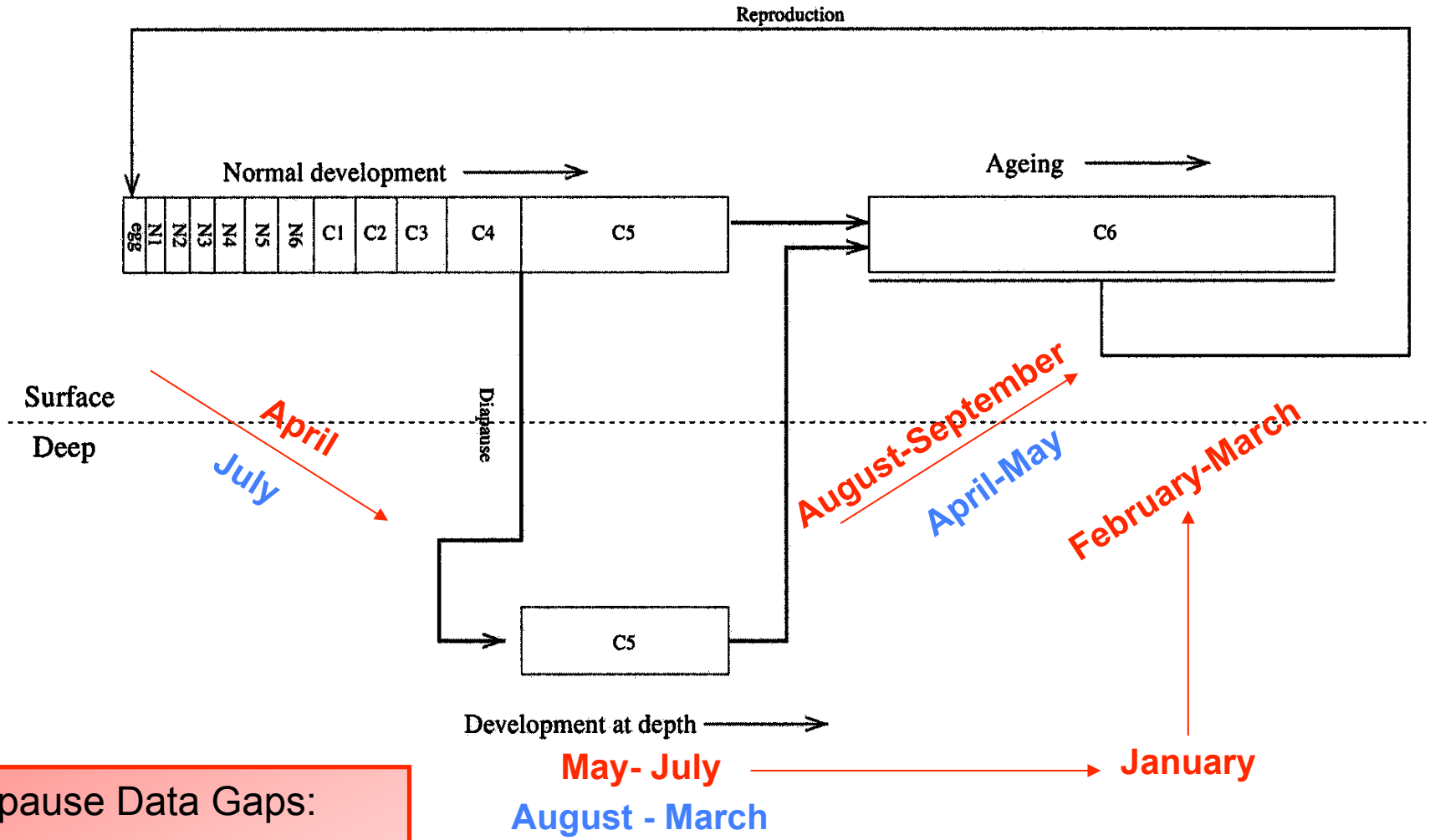
Diapausing strategy

Blue: Absence
Red: Presence
Purple: Presence but low abundance (threshold to define)



First appearance in surface waters of Male and Female *Calanus helgolandicus* at different locations

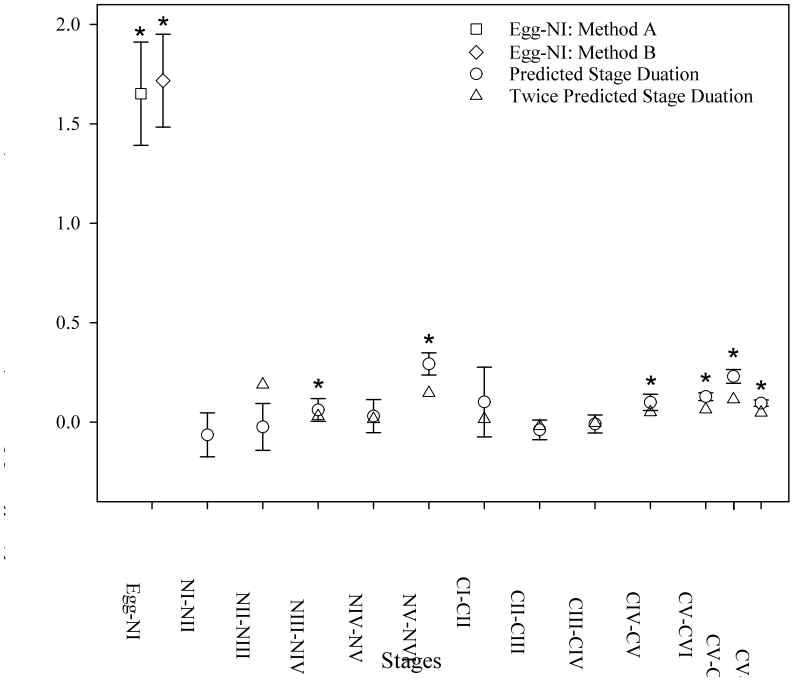
Mediterranean Sea **North Atlantic**



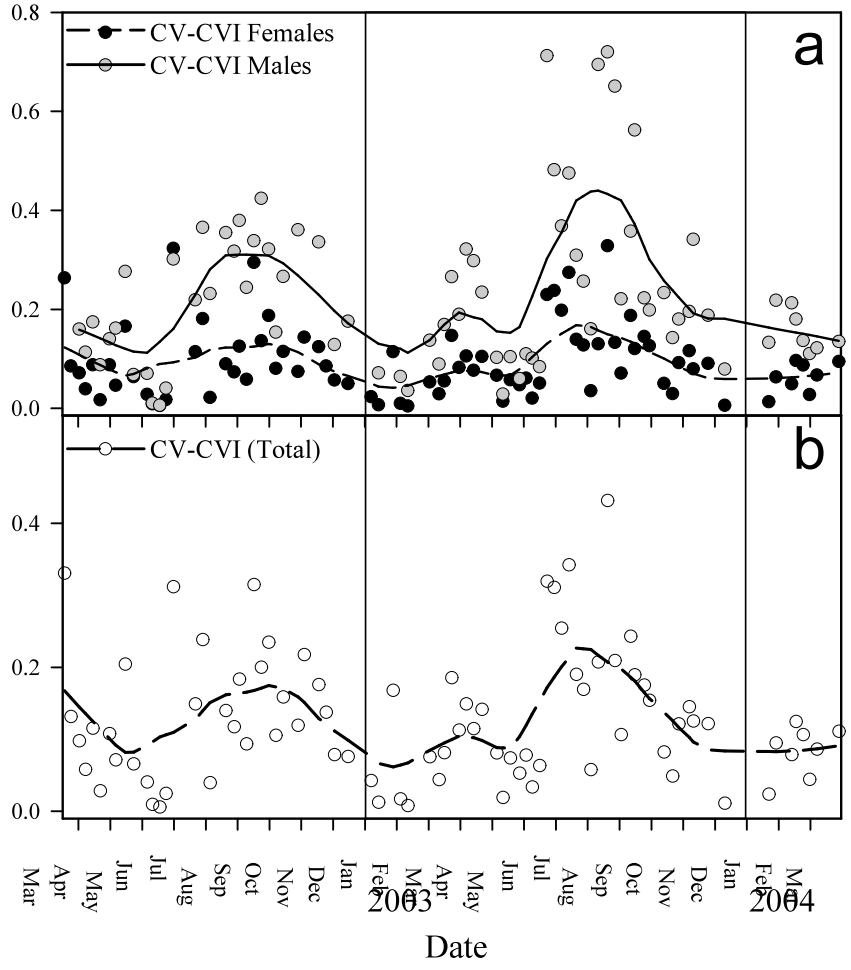
Diapause Data Gaps:

Additionnal data on deep sampling and stage vertical distribution

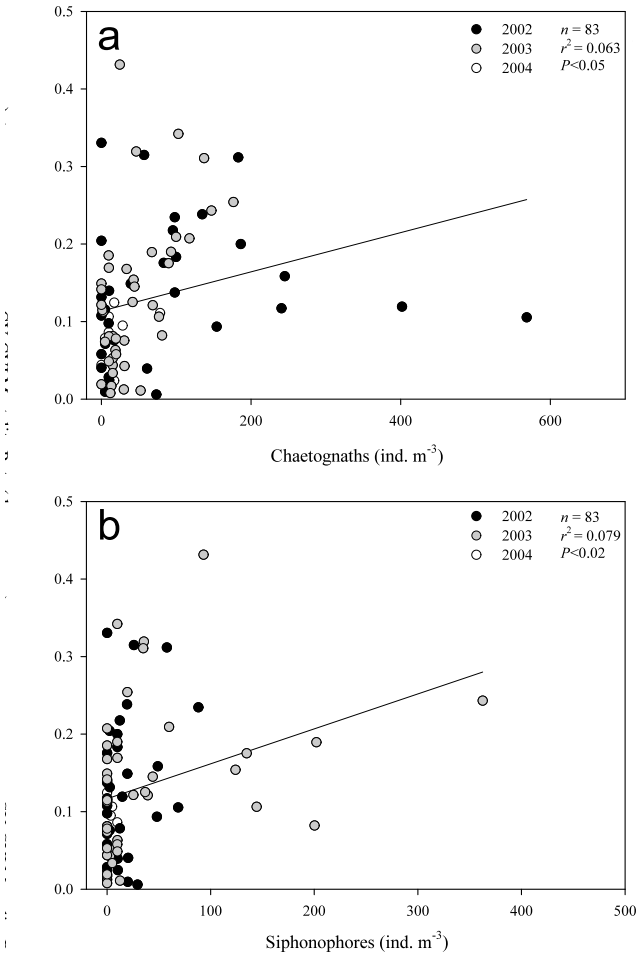
Mortality



Hirst et al. (2009)



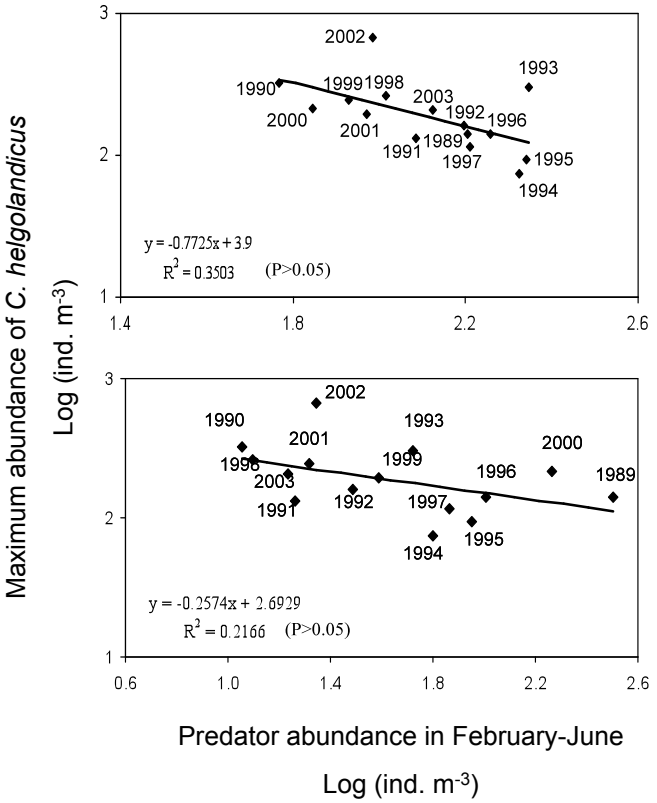
The role of predation in *C. helgolandicus* mortality



Hirst et al. (2009)

Chaetognaths

Siphonophores



Bonnet et al. (2010)

Predation Data Gaps:

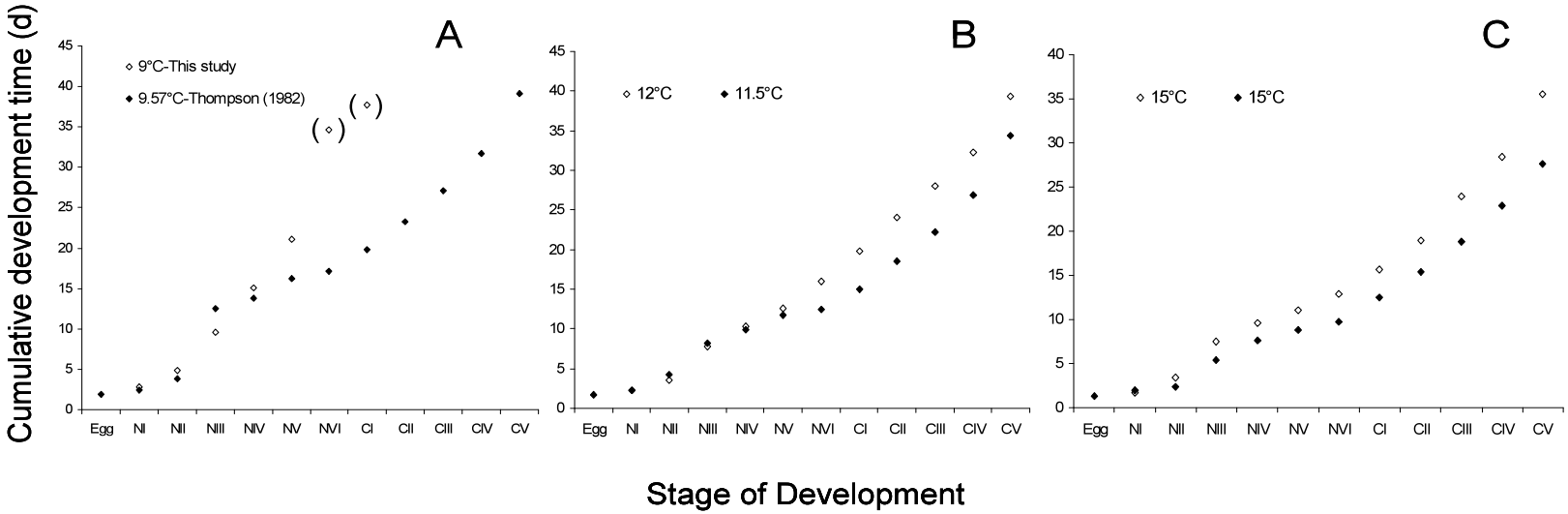
What are the main predators?

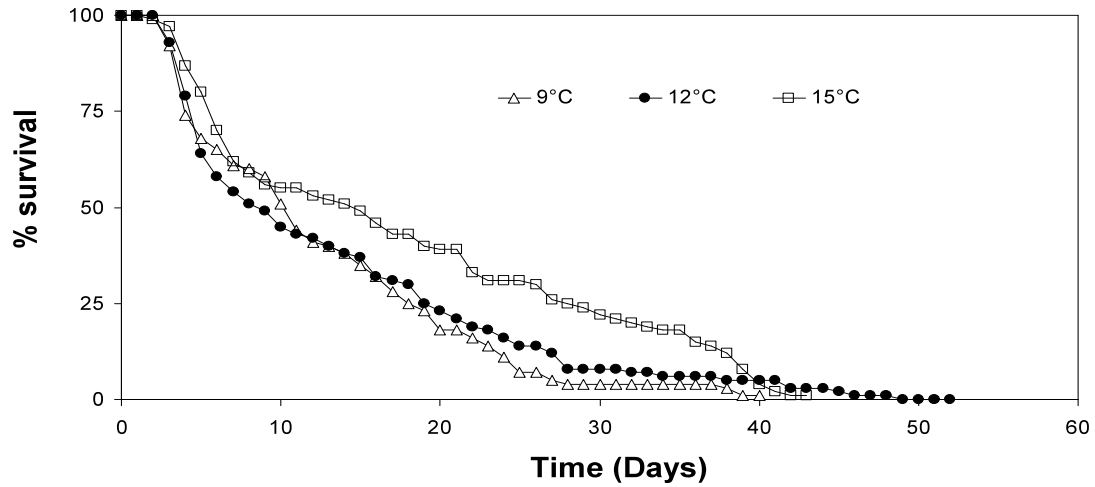
Will they change in the context of climate change?

Development and growth

Temperature

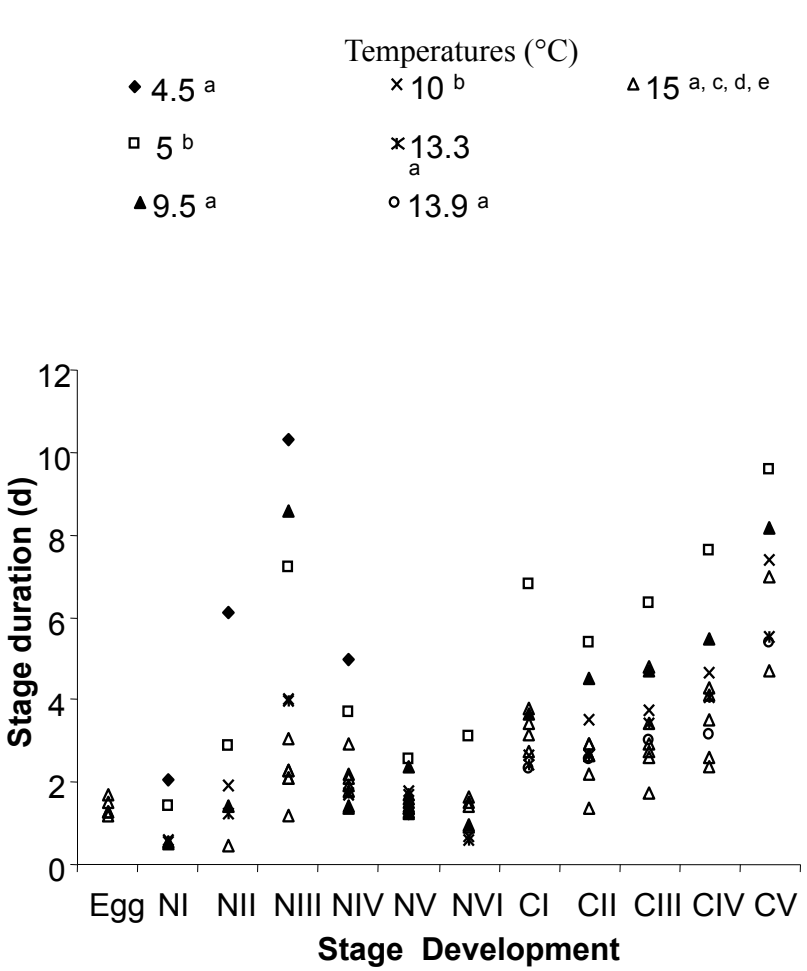
Bonnet et al. (2010)



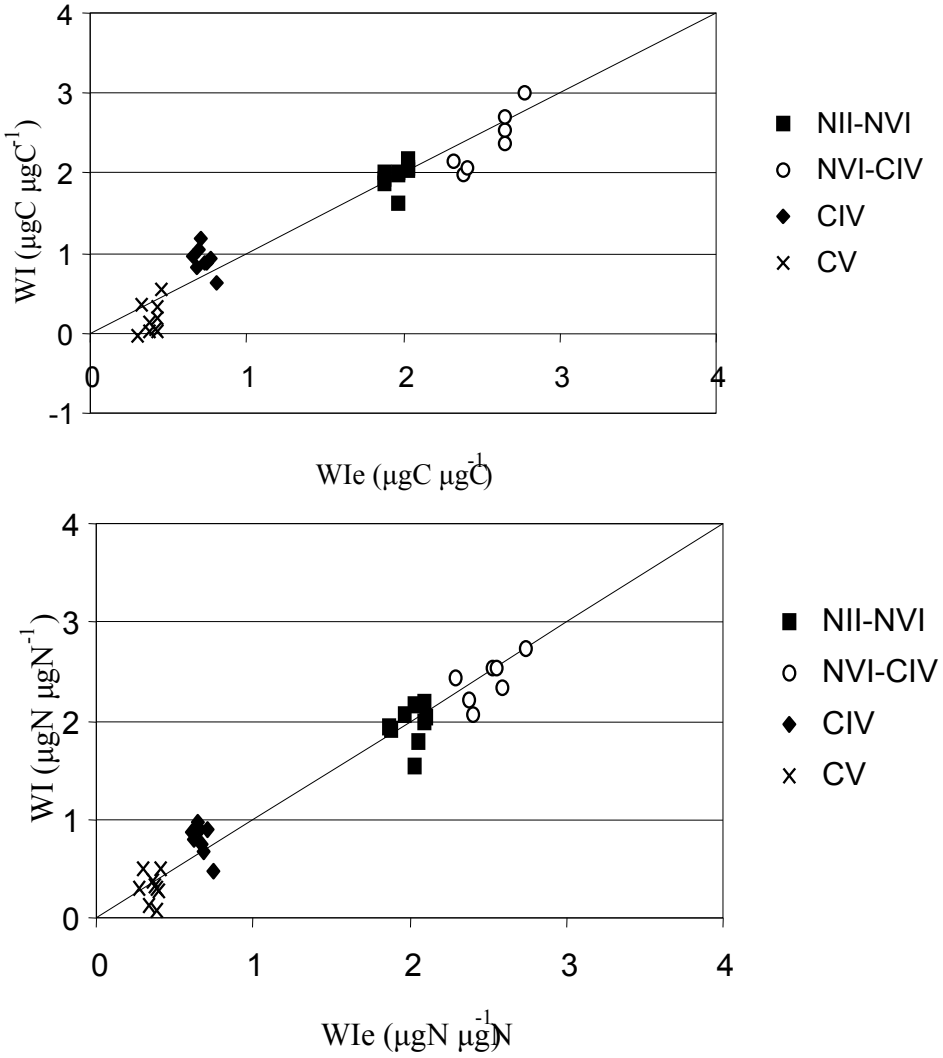


Bonnet et al. (2010)

Development and growth



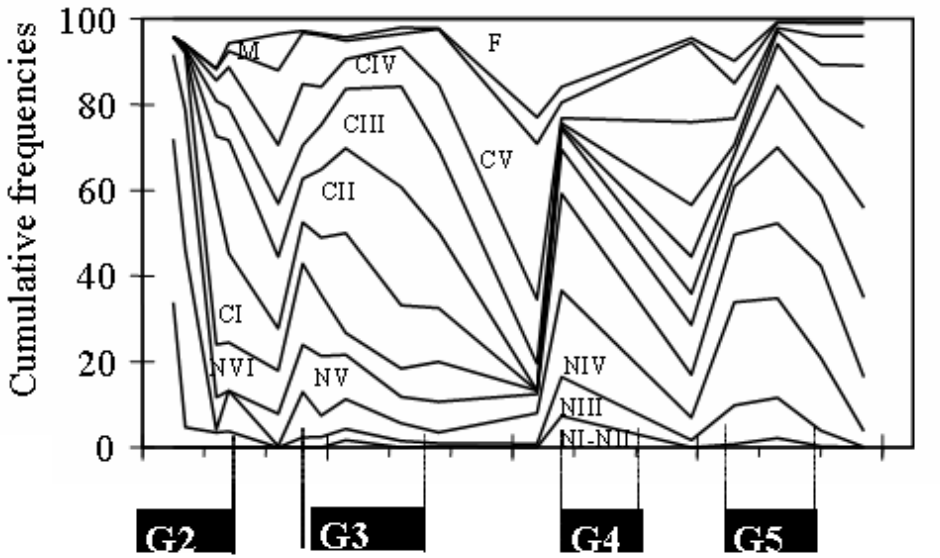
Bonnet et al. (2005)



Rey-Rassat et al. (2004)

DEMOGRAPHY

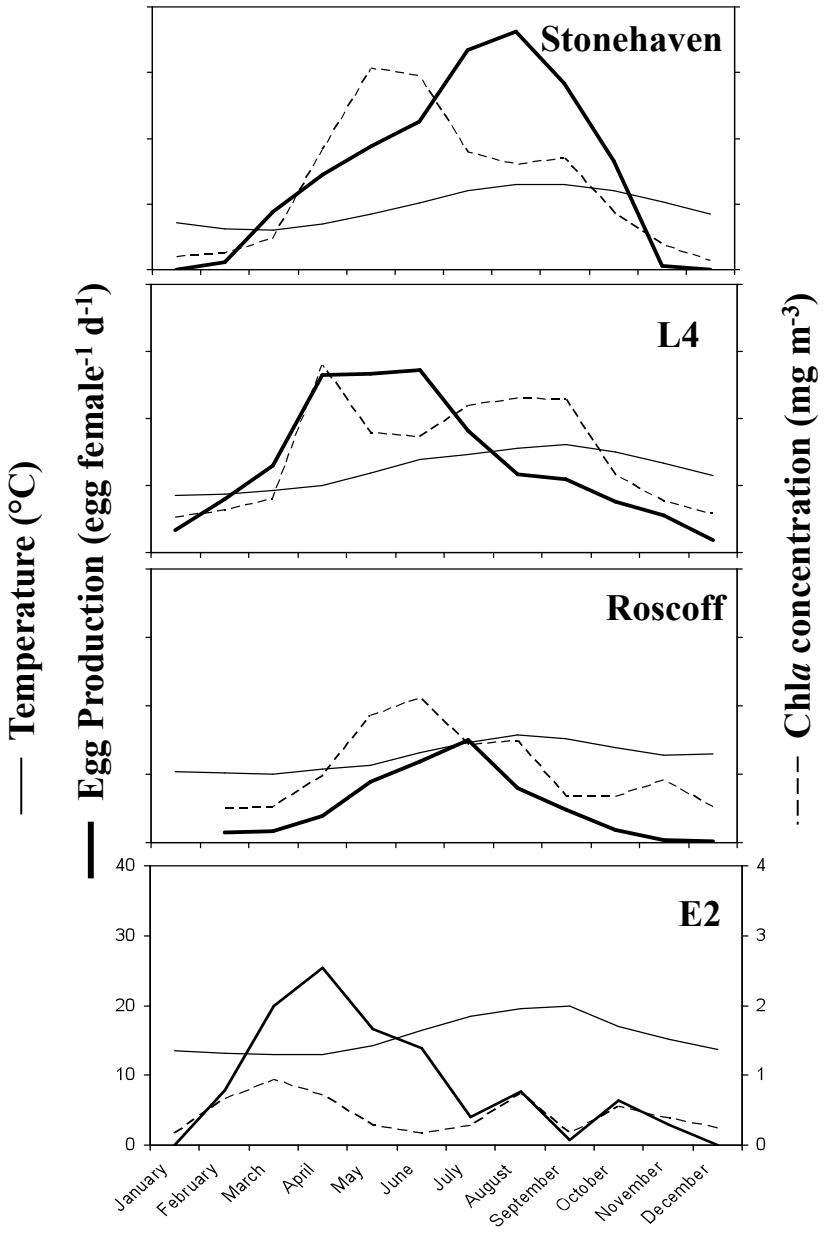
L4



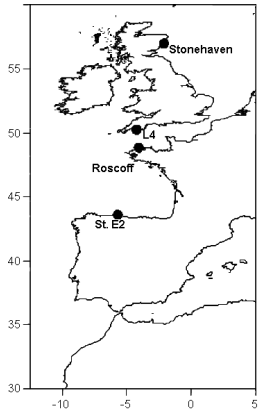
Rey-Rassat et al. (2002)

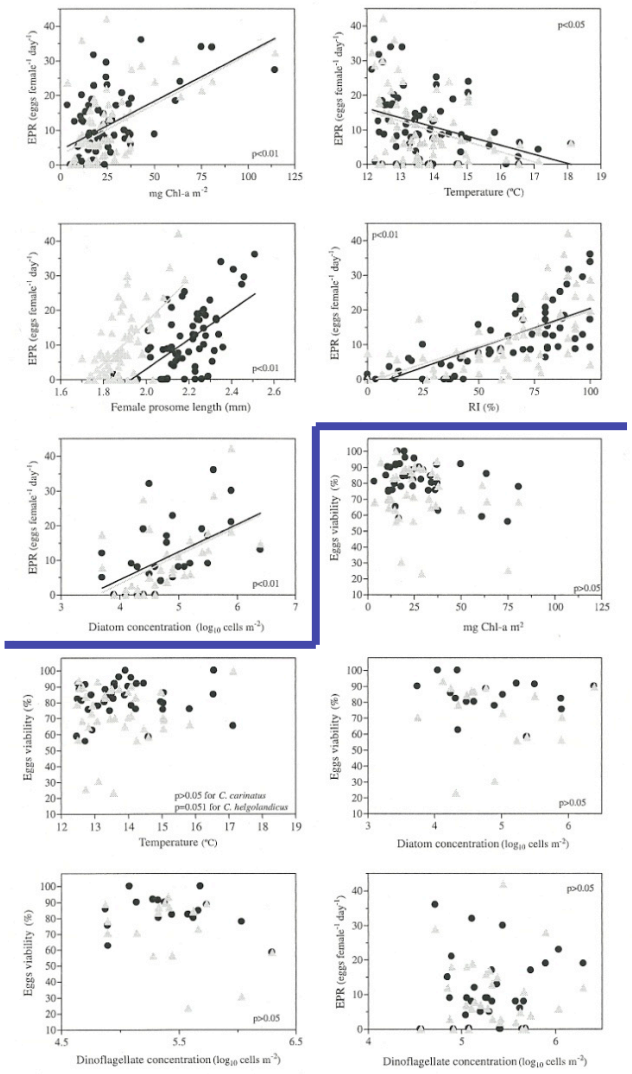
	Calanus helgolandicus	*Calanus finmarchicus*
Latitudinal range	15-65ºN[1,2]	30- 80°N[1]
Temperature range(°C)	5 - 28[3]	0 - 16[4]
Diapause	YES? everywhere?[3,5]	YES[5,6]
Female prosome size range (µm)	1.78-2.8[2,7]	1.95-3.28[8]
Development time: NI-adult (days)	26.2-41.7[9]	45.5-128[10, 11]
Number of generations per year	3-5[12,13]	1-4[14,15]
Maximum egg production (egg female^{-1} d^{-1})	30 - 60[16]	40 – 70[17,18]
Spawning time	Midnight, midday[19]	12.00-16.00, dawn[20,21]
Feeding behavior	Size selective but non-selective for similar size cells[22,23]	Size selective but non-selective for similar size cells[23,24]

Egg production and Hatching Success



Bonnet et al. (2005)





Ceballos et al. (2006)

Conclusions

*Lot of data available but need to assemblade these data

*For some parameters data gap and need to collect more data