Who, what, where, and when:

The estimation of mortality from monitoring data and *Calanus finmarchicus* data in the Gulf of St. Lawrence

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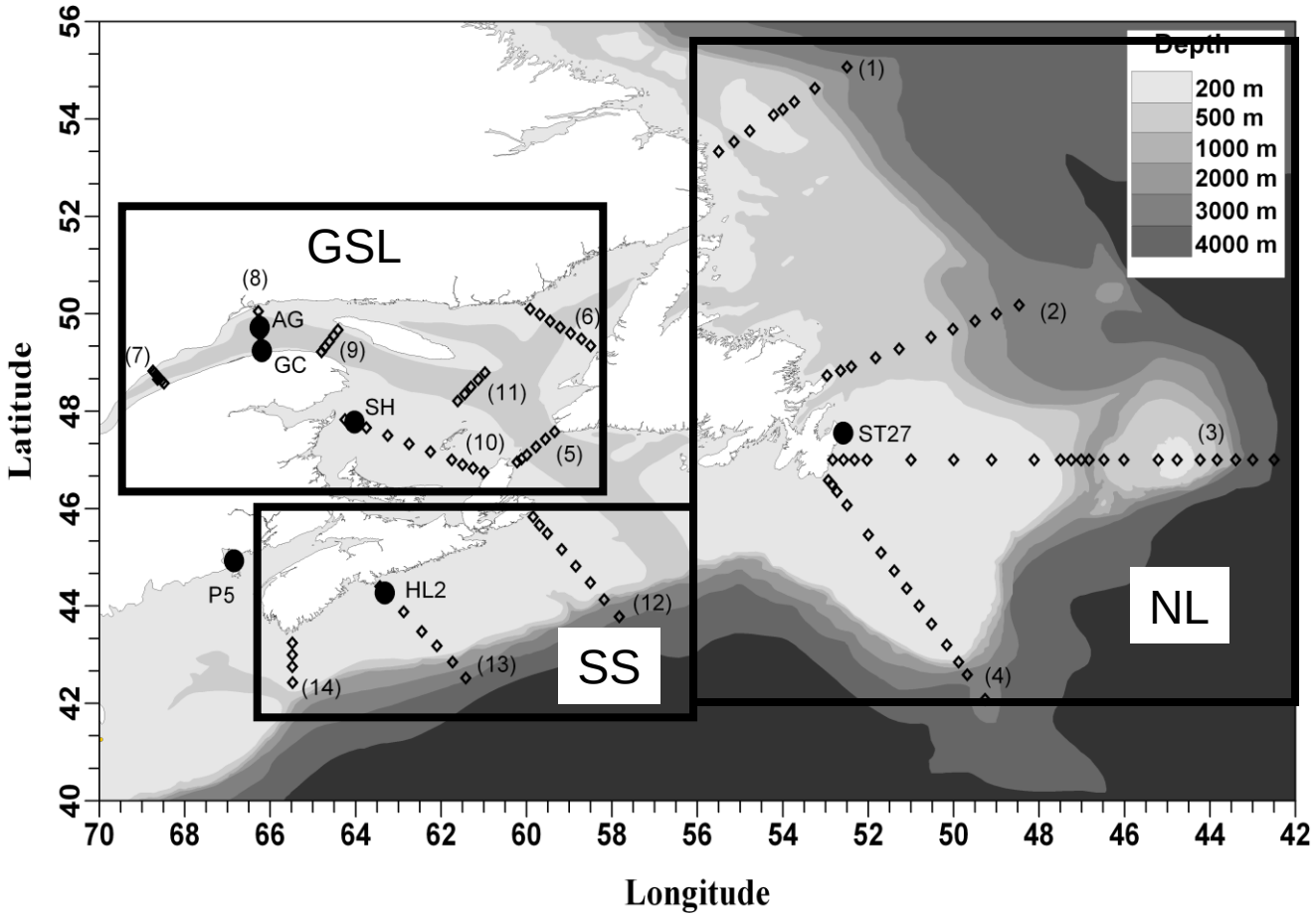
Fisheries and Oceans Canada

S. Plourde, P. Pepin, E Head (2009) ICESJMarSci 66:1942-1958



Objectives

-**Describe and compare long-term stage-specific mortality and survival in *C. finmarchicus* in the Gulf of St. Lawrence (GSL), Newfoundland shelf (NL) and Scotian Shelf (SS) and (2) during different seasons**

- **Describe potential relationships between daily mortality vs environment: temperature, phytoplankton biomass (proxy food), C. finmarchicus C6f (cannibalism, density-dependent processes)**

Data set characteristics

- **AZMP lines visited in April (SS, NL), June-July (GSL-NL) and in October-November (GSL, NL, SS) from 2000 to 2006 (n= 1892)**

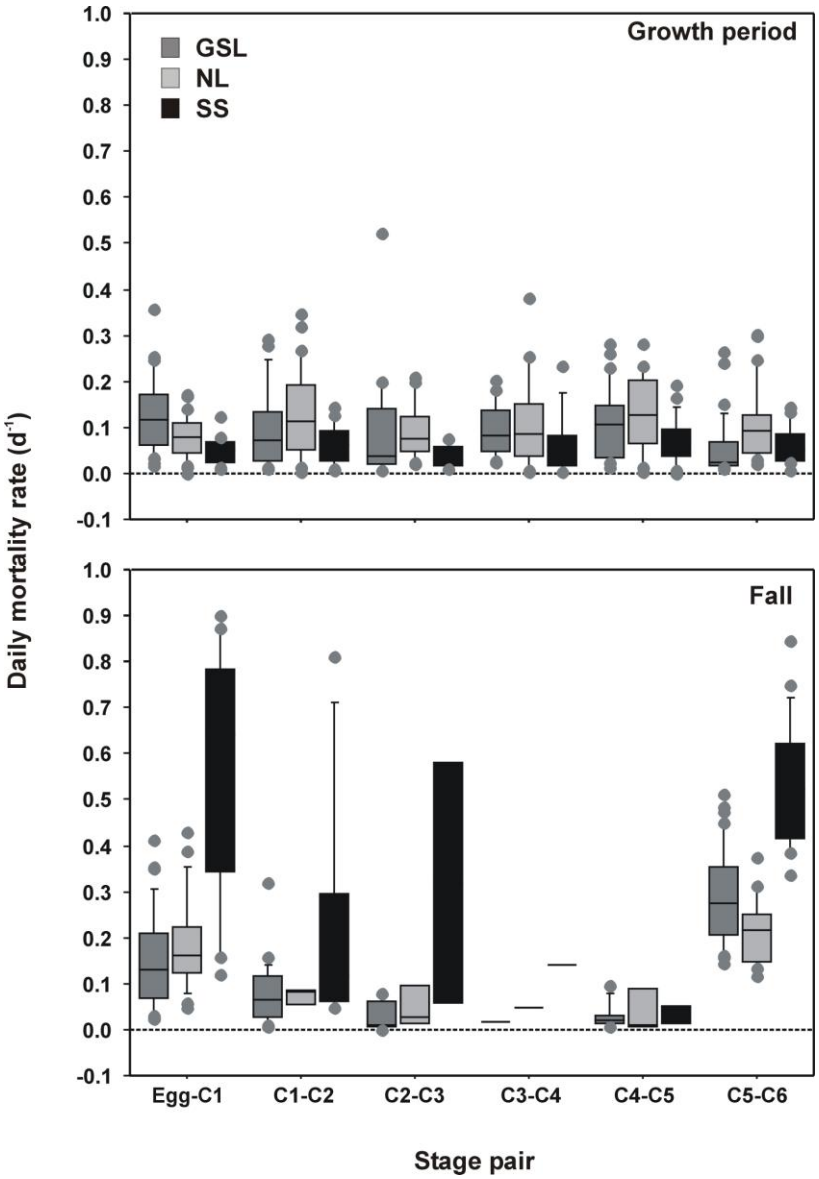
- **Zooplankton sampled with a 0.75-m, 200-µm mesh net from bottom (or 1000 m) to surface**

- **Abundance: C1 to C6 of *C. finmarchicus***

- **Environmental variables at each station: temperature (0-50 m) et chl *a* (0-25 m)**

- **Development time (DT): estimated from temperature (0-50 m)**

- **PopEpr: estimated with region-specific functional relationships Epr vs Chl a in GSL (Plourde et al. 2008) and on NL-SS (Head unpublished)**

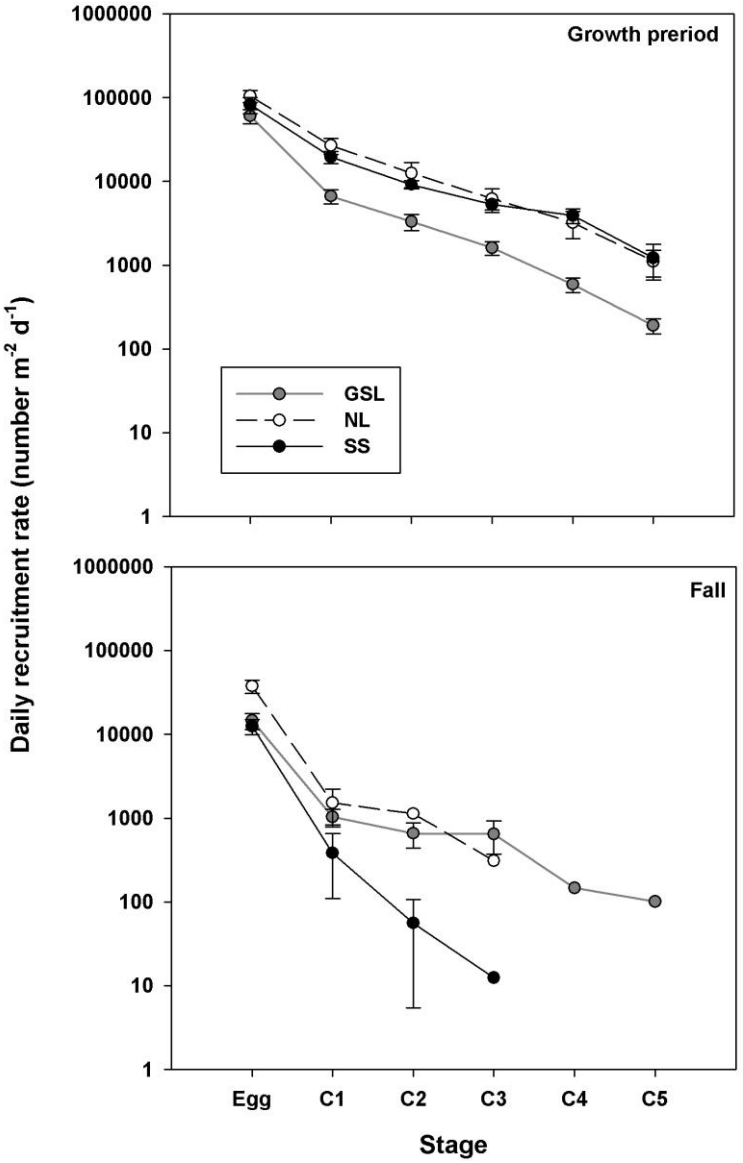


- **Mortality rates different among 'Growth period' and Fall (Mann-Whitney, p<0.0001)**

- **Mortality varied among regions within each season (Kruskall-Wallis, p<0.0001)**

- **Mortality rates very high in Fall on SS, in particular in egg-C1 and C5-C6**

- **Mortality in C4-5 and C5-6: effect of C5 in diapause**



- **PopEpr X survival egg-C1= C1 m^{-2} d^{-1}**
- **C1 m^{-2} d^{-1} X survival C1-C2= C2 m^{-2} d^{-1}**
- **etc…..**
- **'Survival trajectories' in regions and seasons**
- **Representation of how a population model would work (stage-specific daily recruitment= transfert functions)**

- **'Growth period': lower survival egg-C1 in GSL= lower recruitment than on NL and SS**
- **Trajectories C1-C5: similar in GSL, NL, SS**

- **Fall: low survival egg-C1 in all regions**
- **SS: very low survival and recruitment to C3**

- **Population losses: > during egg-C1**
- **Could be very important to determine the overall success of the population**

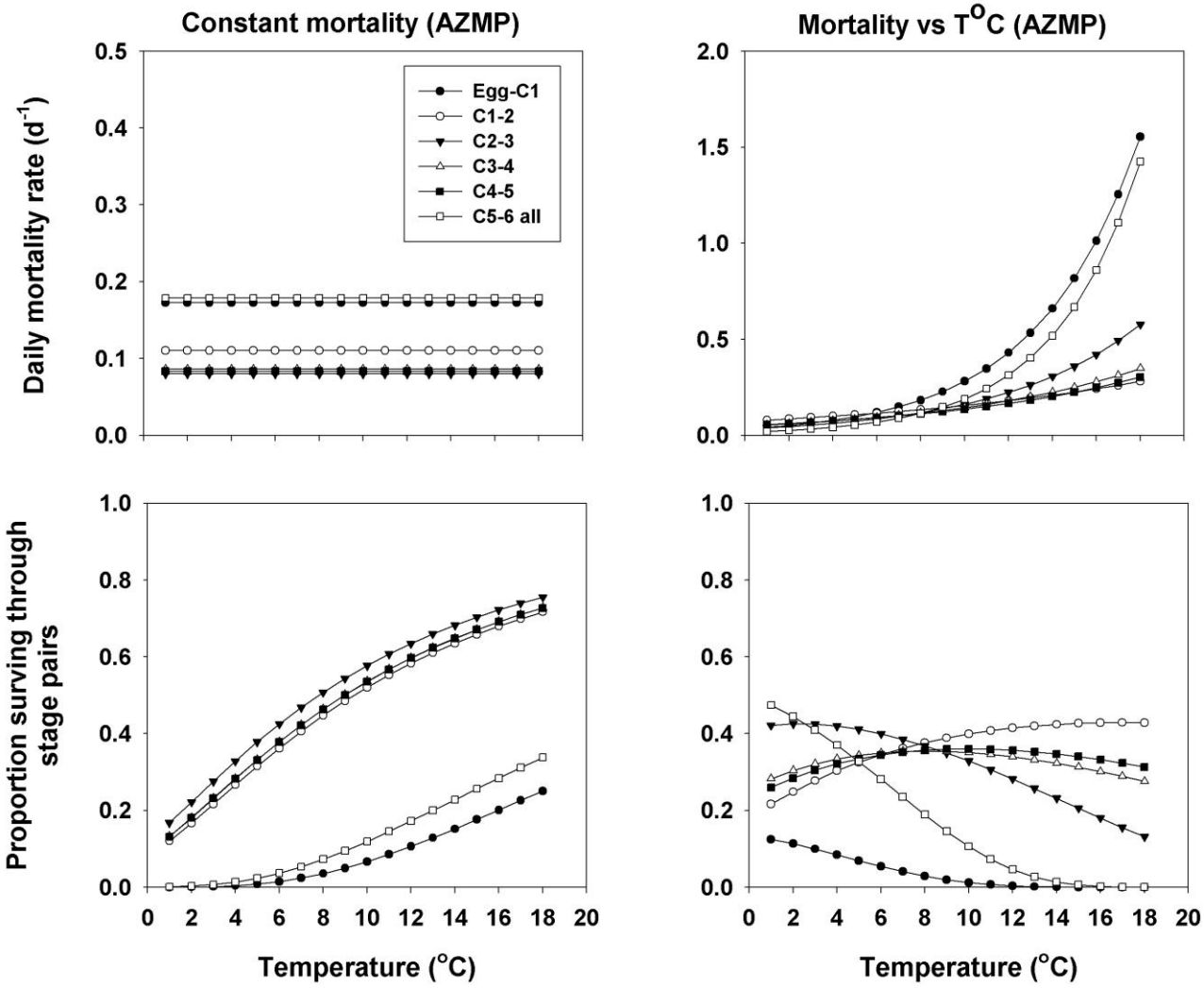
AZMP 2000-2006: Daily mortality rate vs temperature

Stage	r^2	*p*-value	*a*	*b*
Egg-C1	0.700	<0.0001	0.033	0.214
C1-C2	0.074	0.003	0.074	0.074
C2-C3	0.172	<0.0001	0.033	0.159
C3-C4	0.177	0.0007	0.048	0.110
C4-C5	0.171	<0.0001	0.050	0.100
C5-C6 Growth	0.659	<0.0001	0.015	0.253
C5-C6 Autumn	0.802	<0.0001	0.137	0.105

- **Significant relationship mortality vs temperature in all stage pairs**

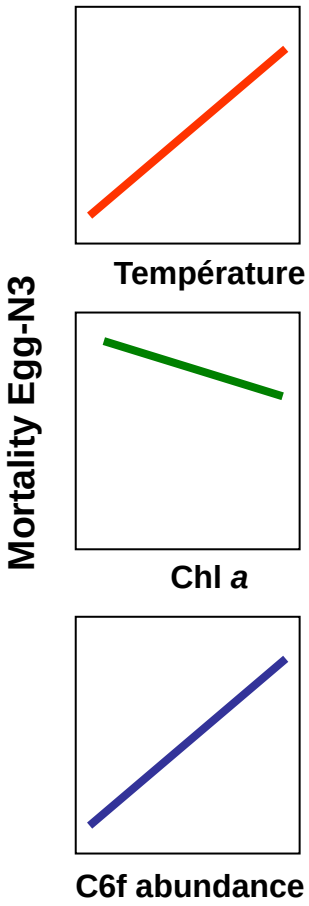
- **High R^2: egg-C1 et C5-C6**

Biological model: using constant mortality vs temperature-dependent mortality: results in very different survival



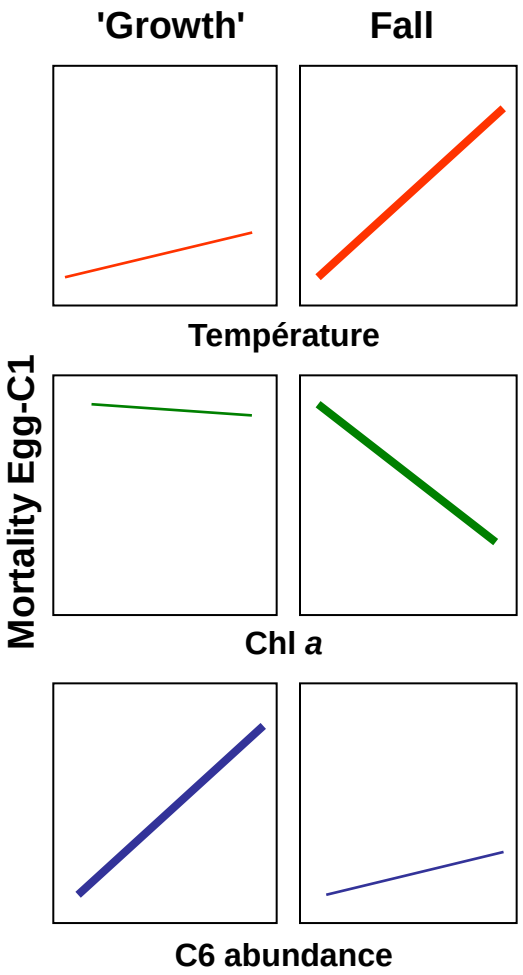
Summary of different multiple linear regression models (all p< 0.05)

STN Riki 1994-2006



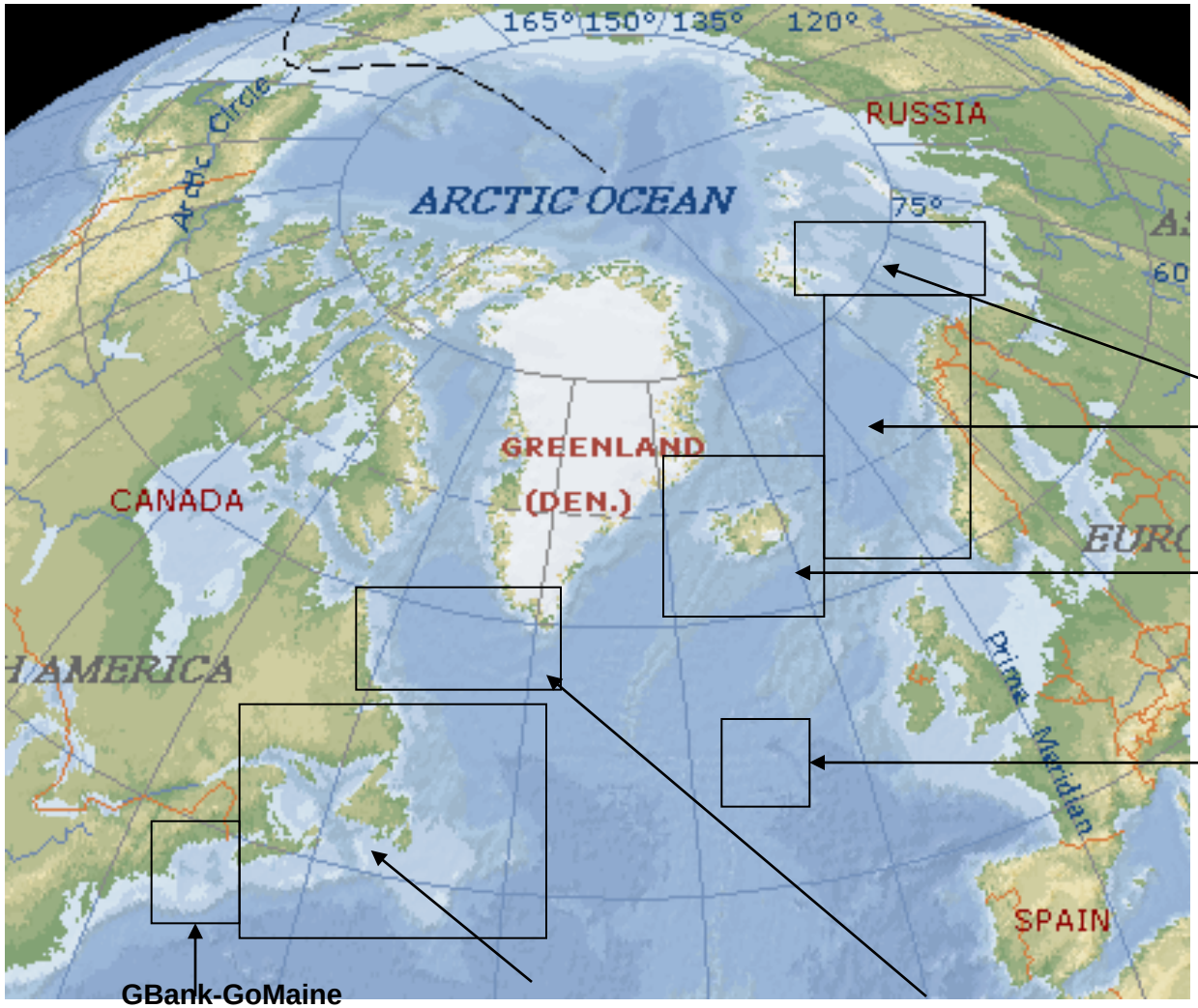
Plourde et al. (2009) JPR 31 (4): 371-388

AZMP 2000-2006



Plourde et al. (2009) ICESJMarSci 66:1942-1958

Potential *C. finmarchicus* data sets for mortality comparisons



Norwegian Sea and Barents Sea (Melle)

Iceland (Gislason)

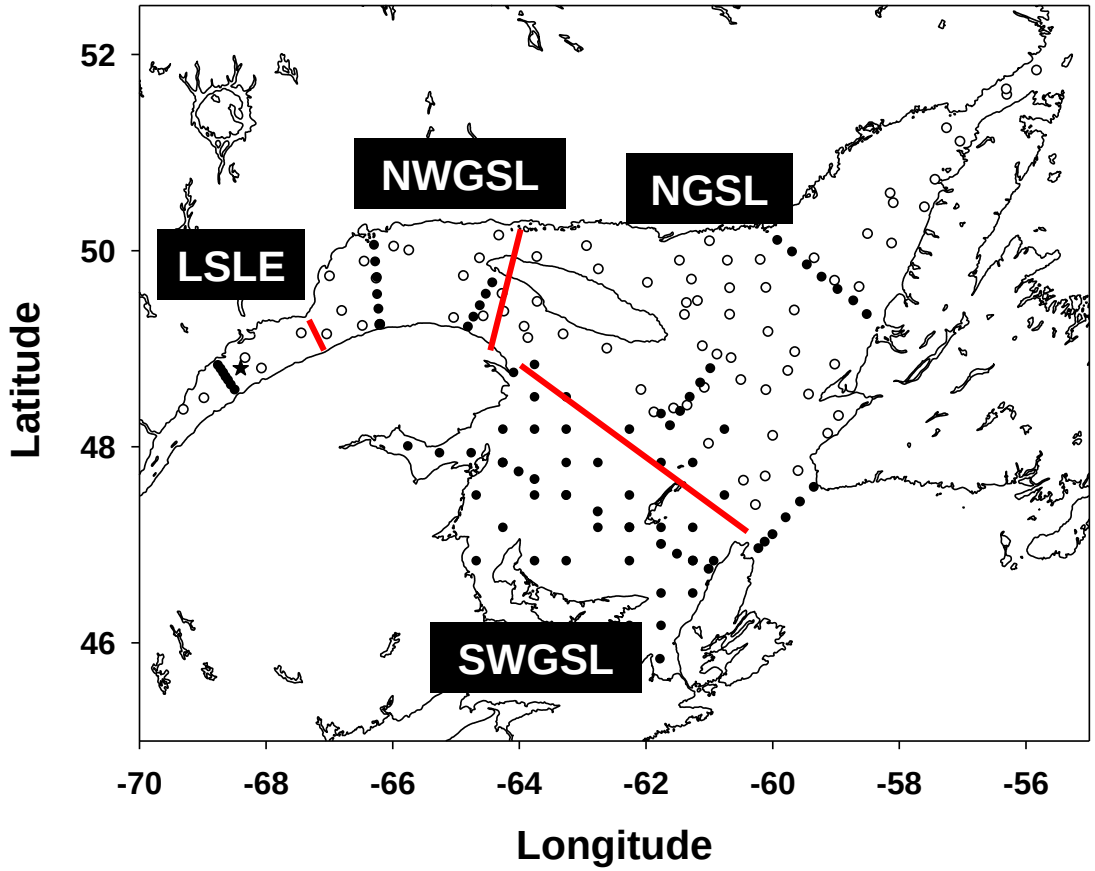
Station India (Irigoien, Harris)

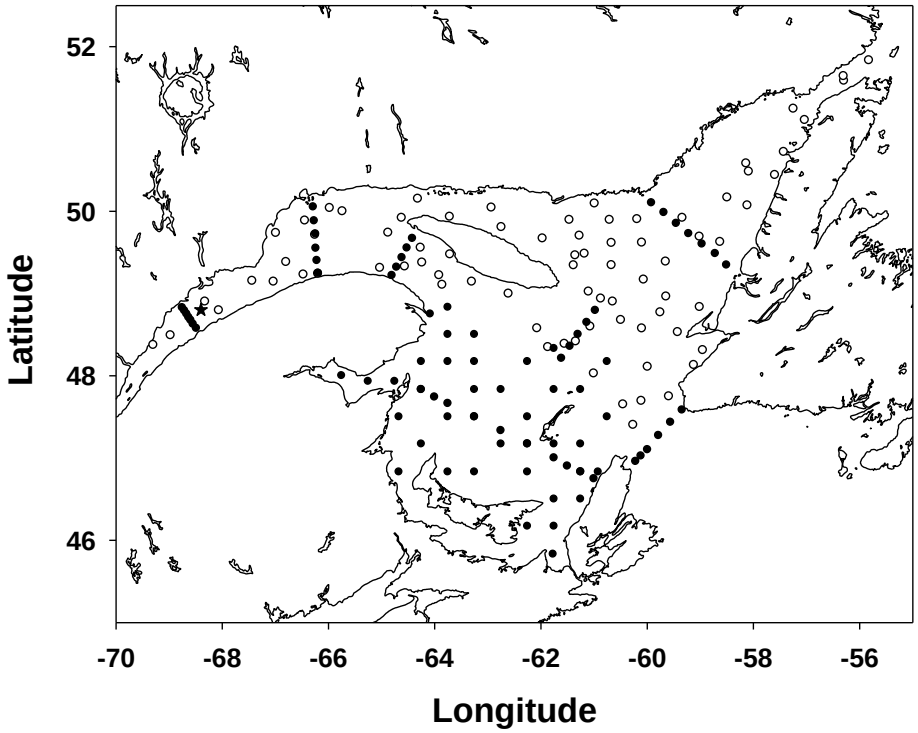
GBank-GoMaine (Ohman, Durbin, Runge, Johnson, etc….)

AZMP (Plourde, Pepin, Head, Johnson)

Labrador Sea (Head et al)

Calanus finmarchicus data inventory in the Gulf of St. Lawrence (lots of credits to Jeffrey Runge!)

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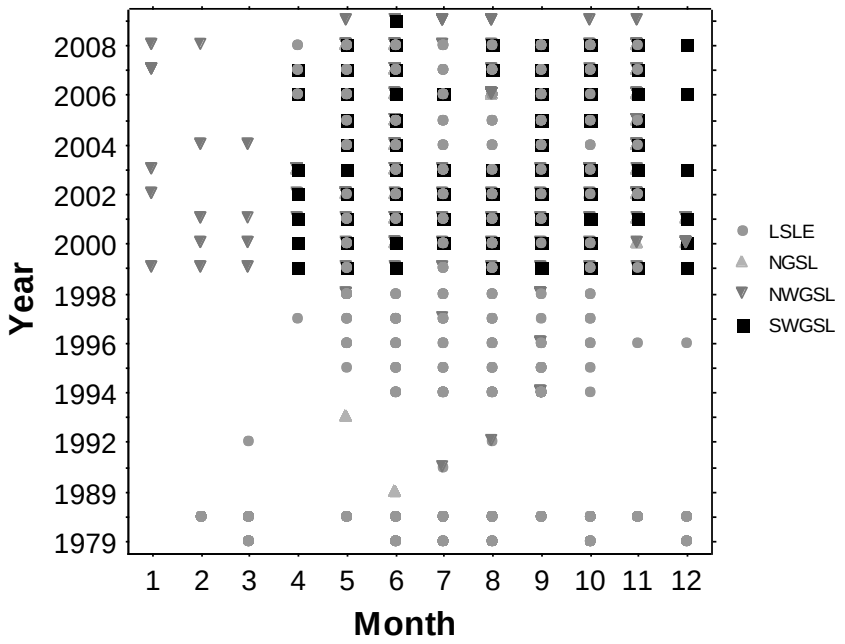
-58
-56
Longitude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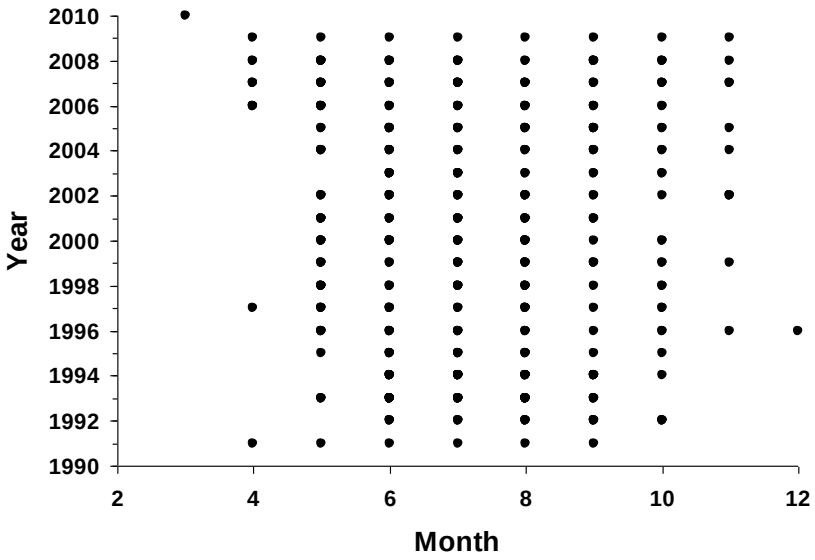
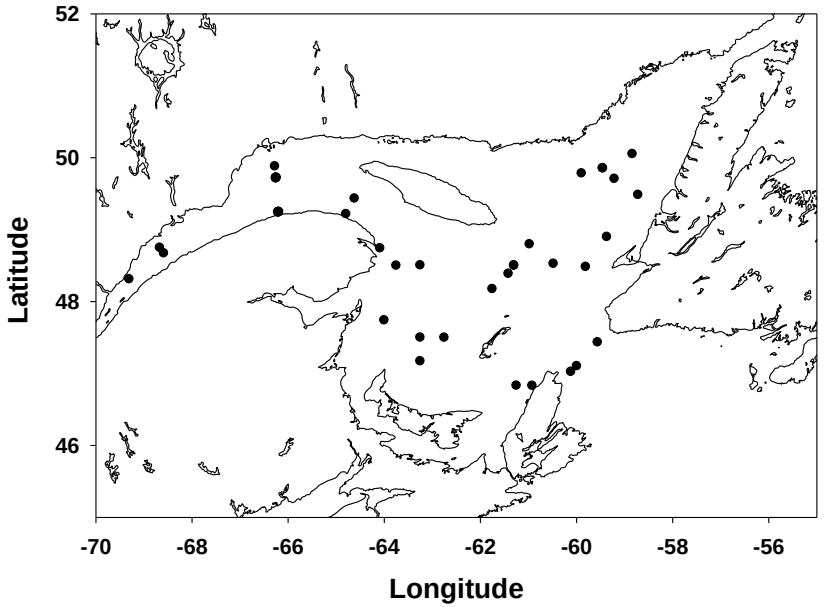
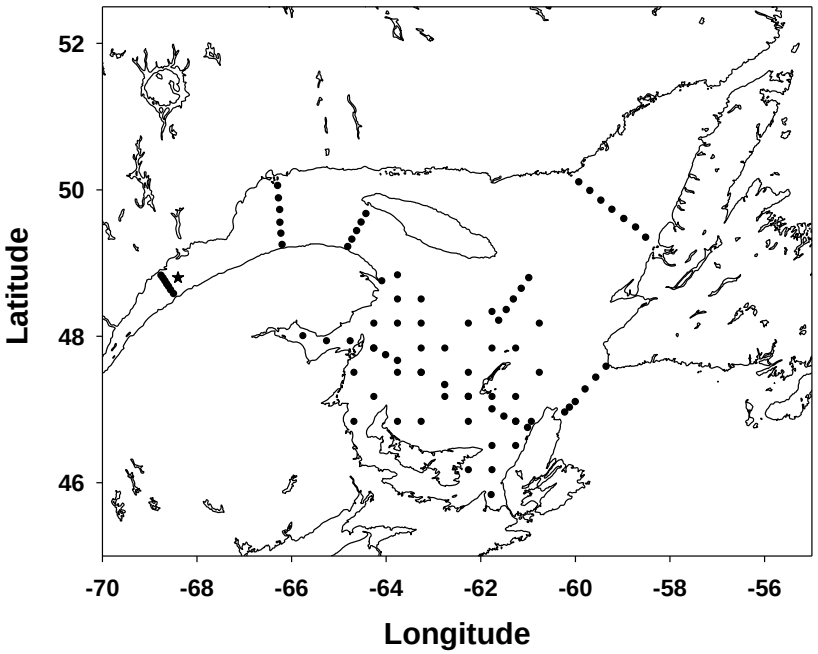
LSLE
NGSL
NWGSL
SWGSL

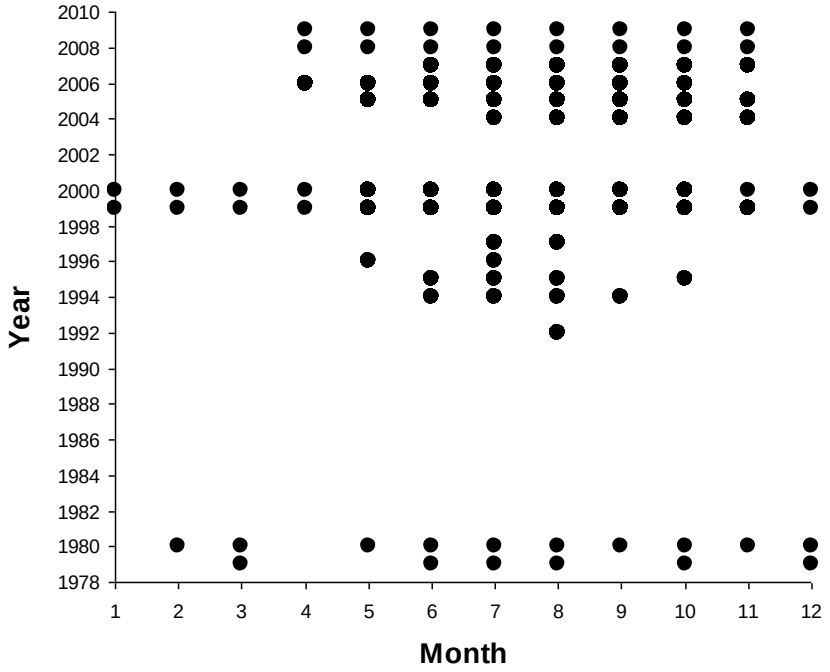
1991 to present: core of data from Riki STN



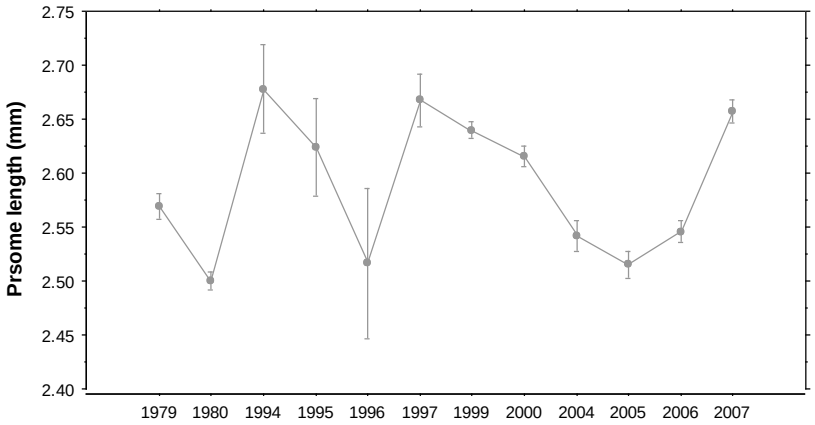


Data Inventory: prosome length

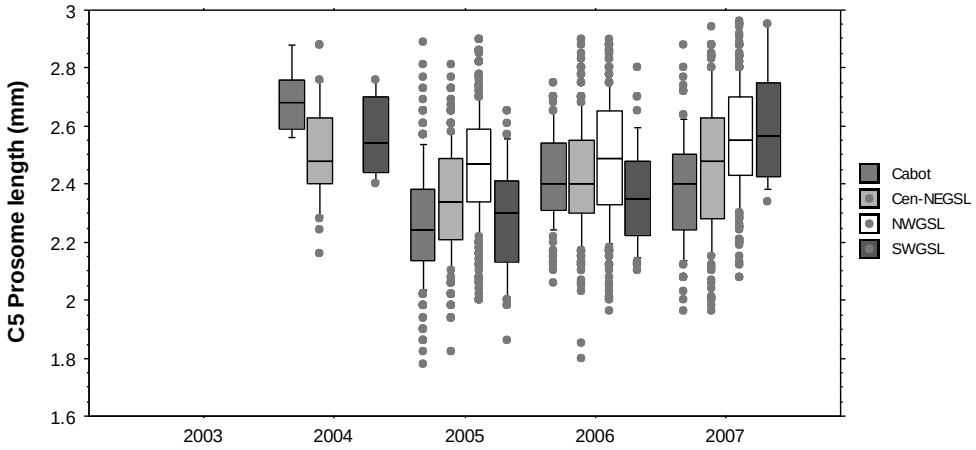




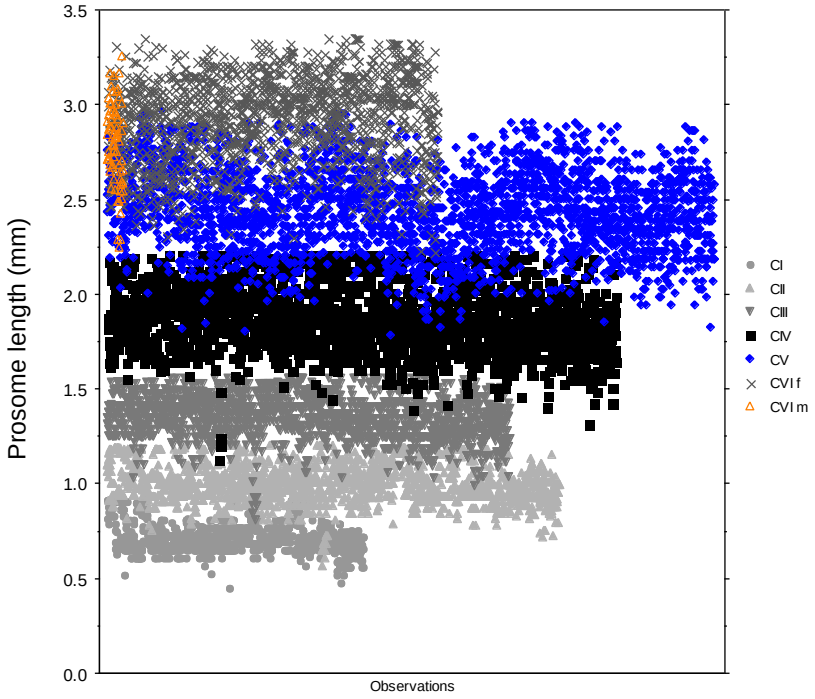
C5 Riki STN: annual mean

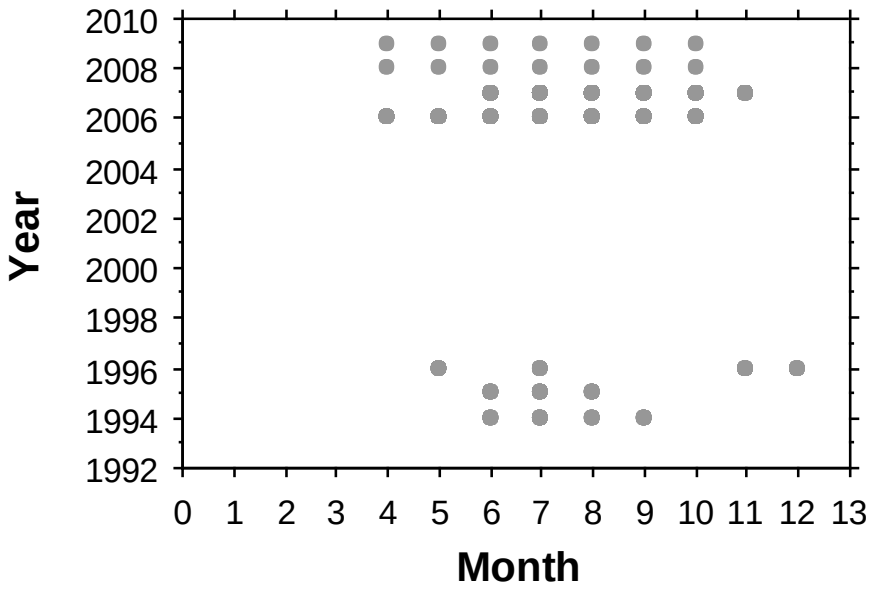


C5 AZMP: Fall annual mean



AZMP: all stages

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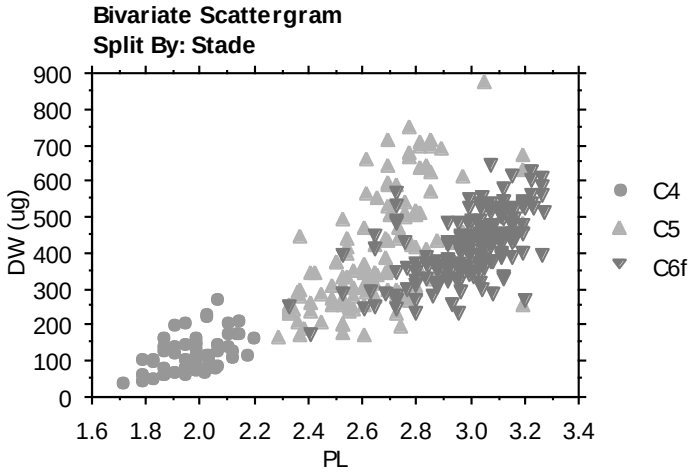
Month


Bivariate Scattergram
Split By: Stade
DW (ug)
900
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PL
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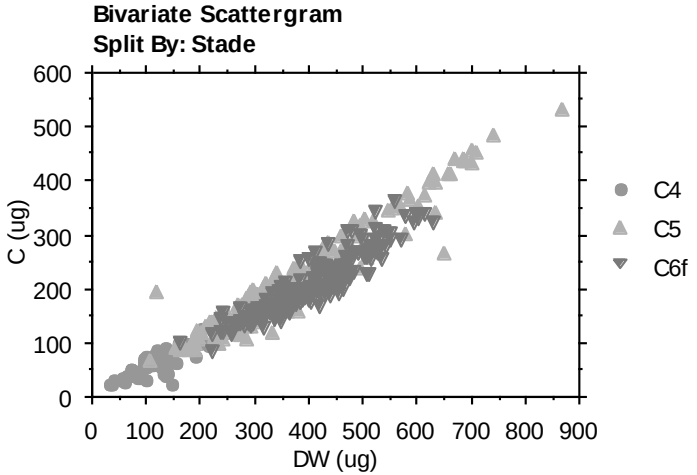
C6f


Bivariate Scattergram
Split By: Stade
C (ug)
600
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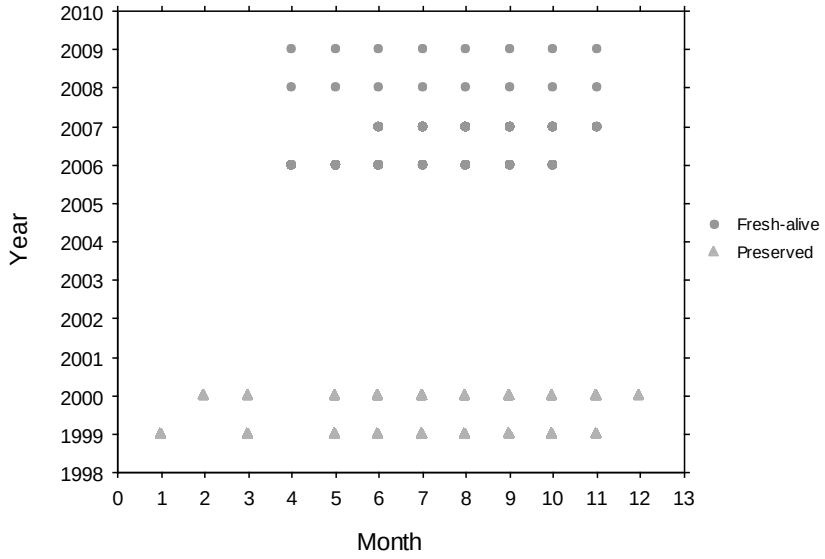
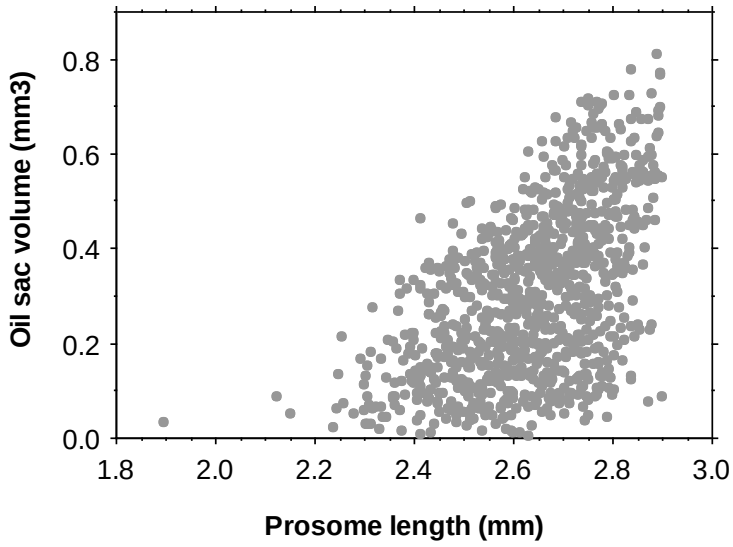
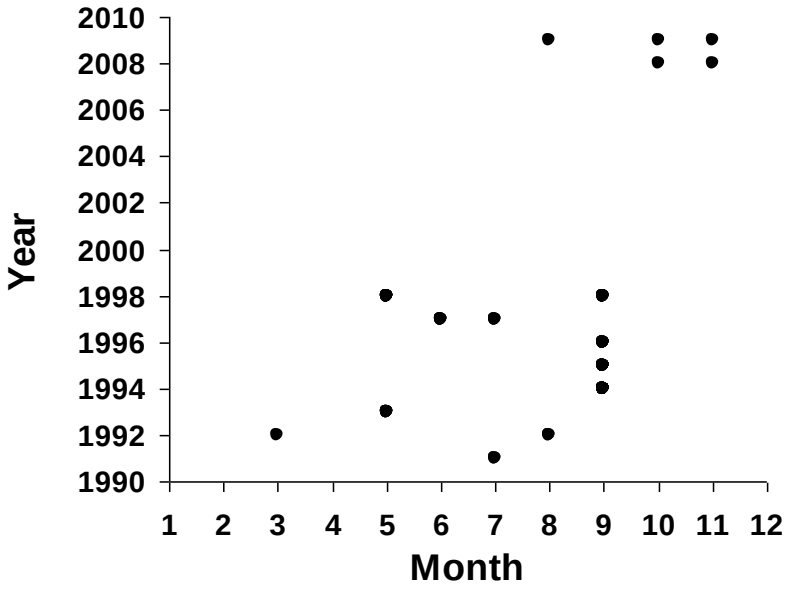
0 100 200 300 400 500 600 700 800 900
DW (ug)
C4
C5
C6f

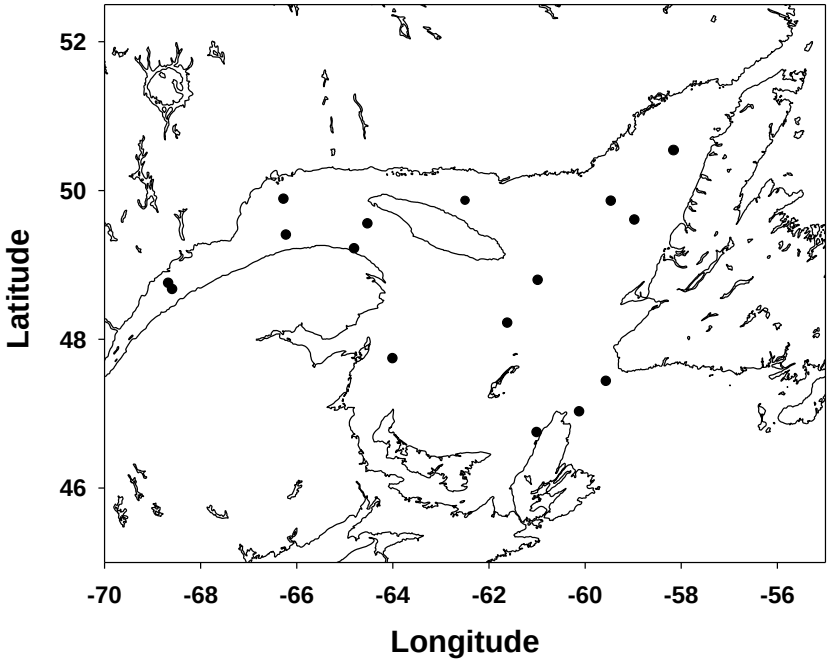
Riki STN and AZMP fixed stations in NwGSL



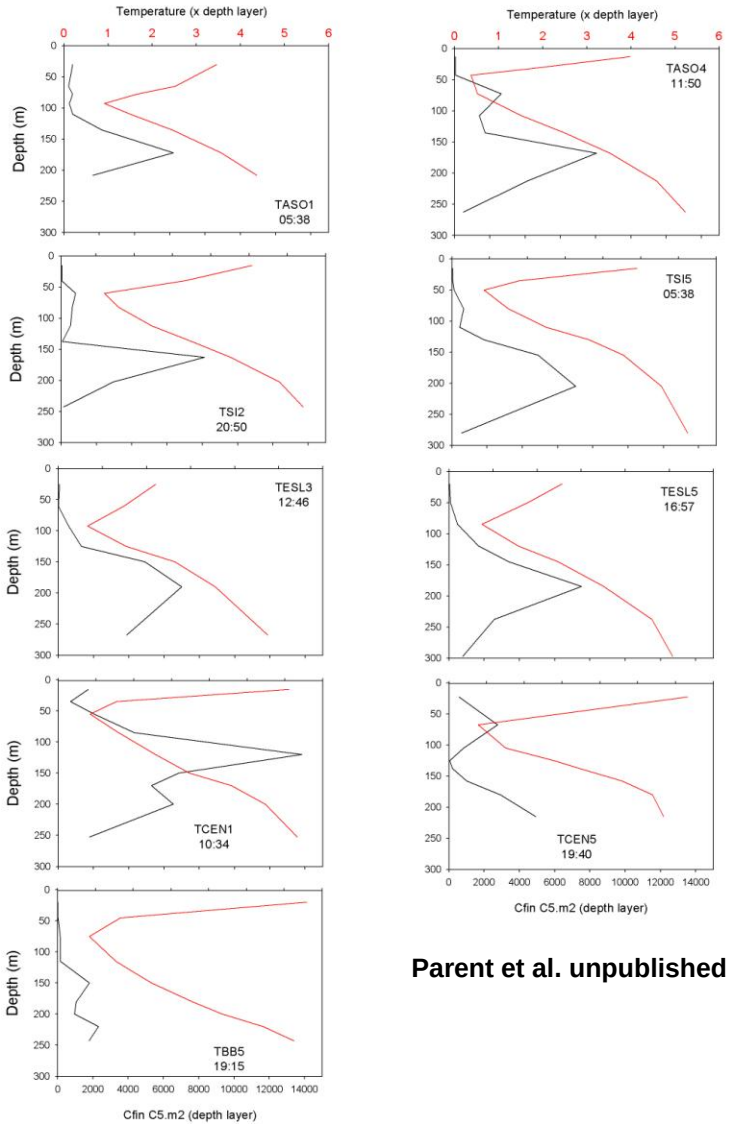


Sampling with BIONESS mostly in LSLE and NWGSL, but on AZMP lines in Fall 2008-2009:
Few more sites in GoSL have been sampled but not in data set yet

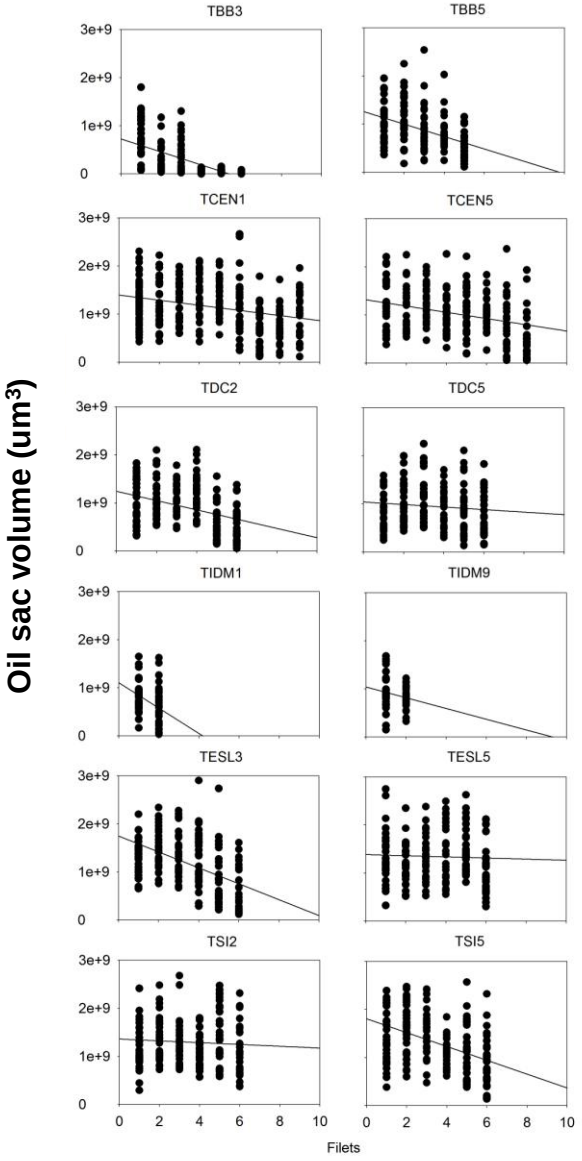




AZMP Fall 2008-2009: vertical distribution and lipid volume in 1°C isotherms

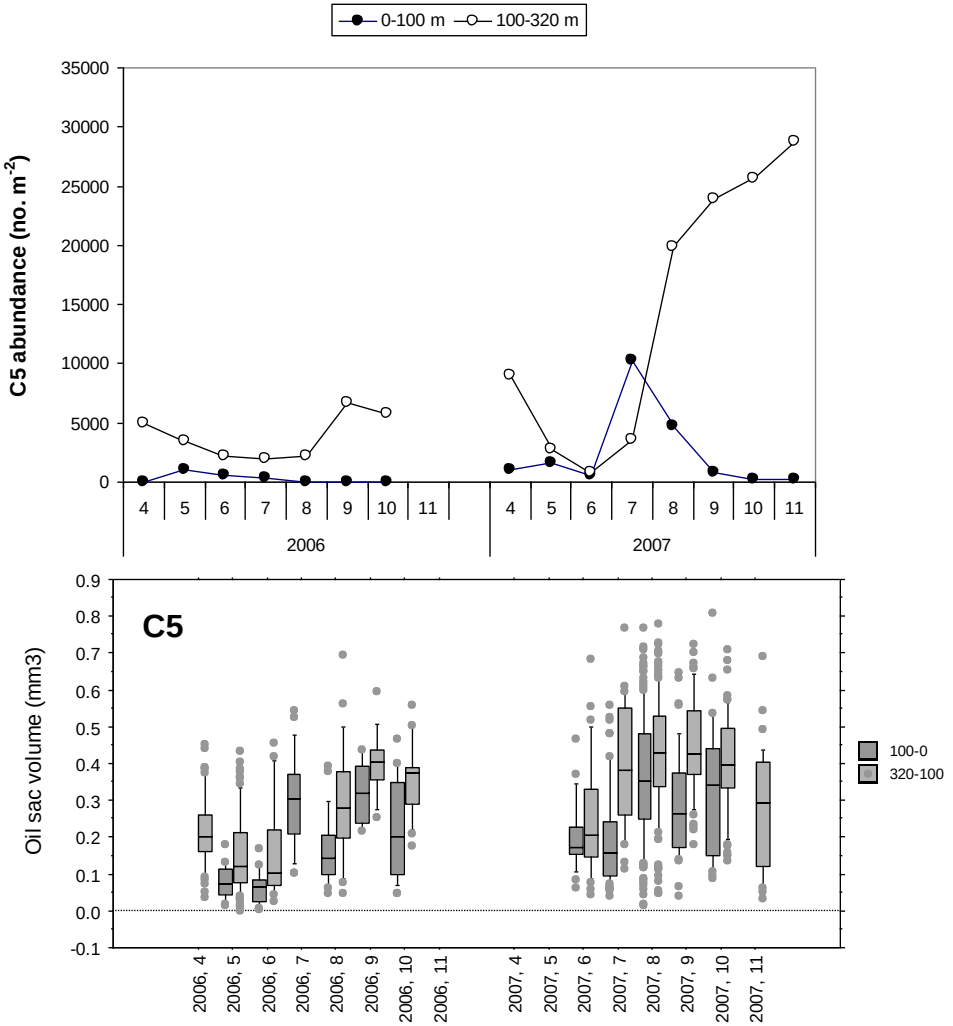


Parent et al. unpublished



Parent et al. unpublished

Rimouski Station 2006-present: sampling of 2 different depth layers (0-100m, 100-320m)



Month/year