Effects of bottom temperature on growth of Snow Crab: A comparison between the Newfoundland-Labrador Shelf and the southern Gulf of St. Lawrence

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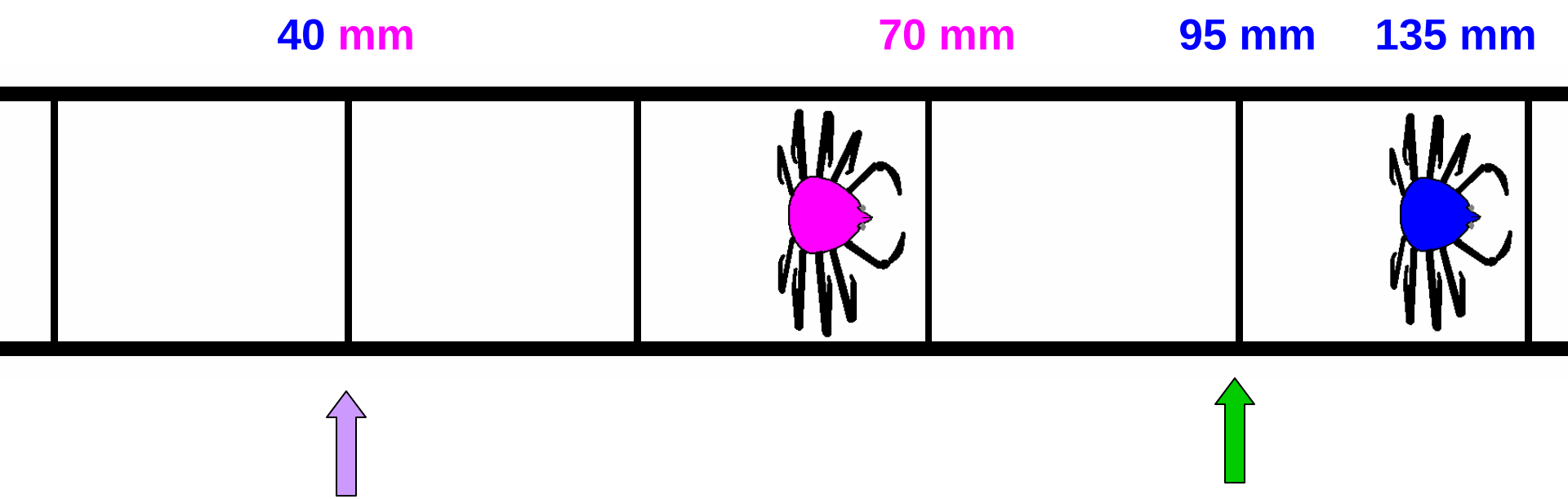
Outline

- Background; snow crab life history
- Effects of bottom temperature on size-at terminal molt, by sex
- Effects of bottom temperature on male molting frequency (skip molting)
- Conclusions:

  What is the overall effect of variation in the thermal regime on snow crab populations?

Male, Female

Snow Crab Life Cycle



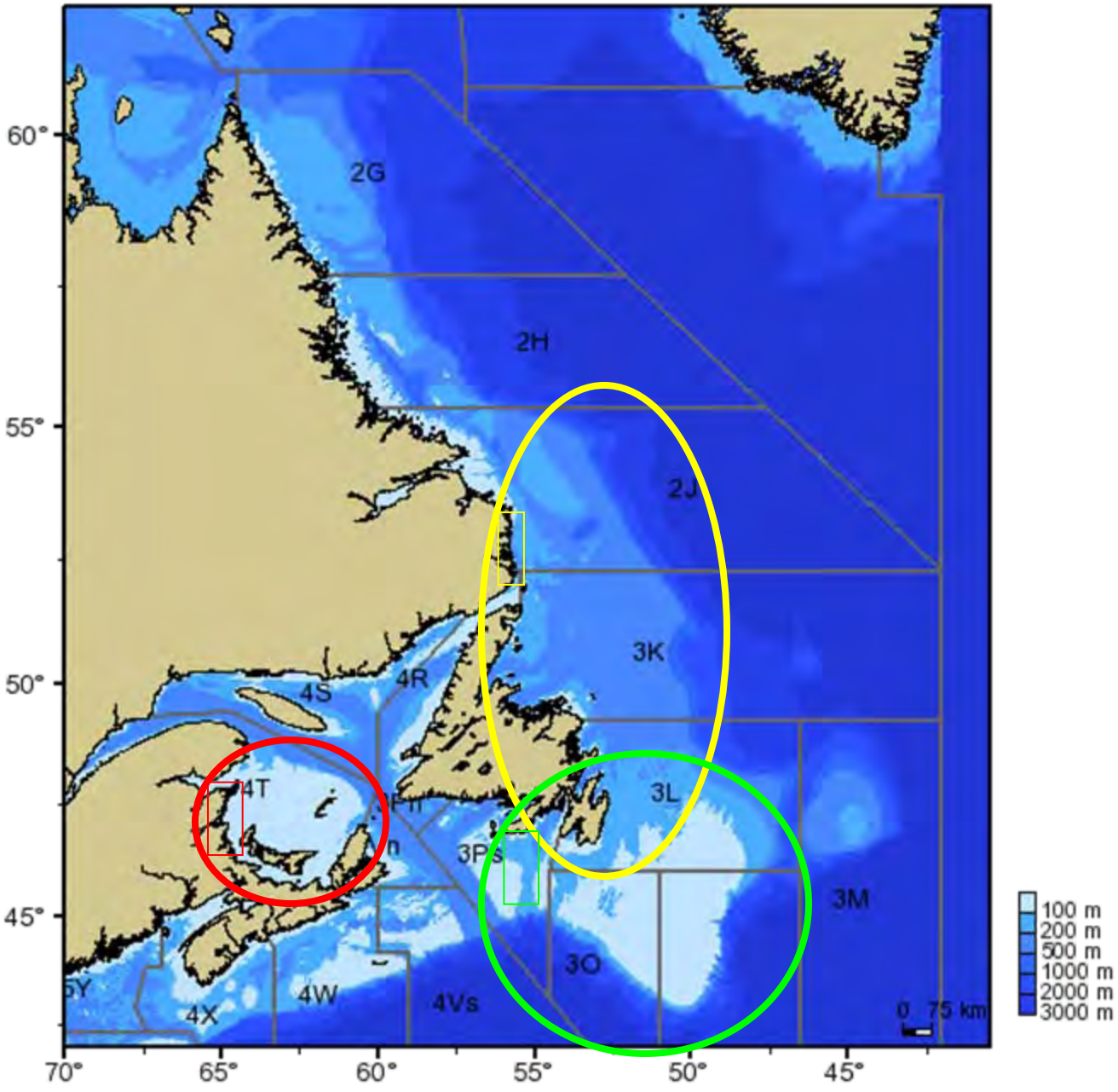
Combination small claw and spermatophores is **adolescent** (also called ‘morphometrically immature’ or ‘small-clawed’).

Combination large claw and spermatophores is **adult** (also called ‘morphometrically mature’ or ‘large-clawed’).

Shell condition

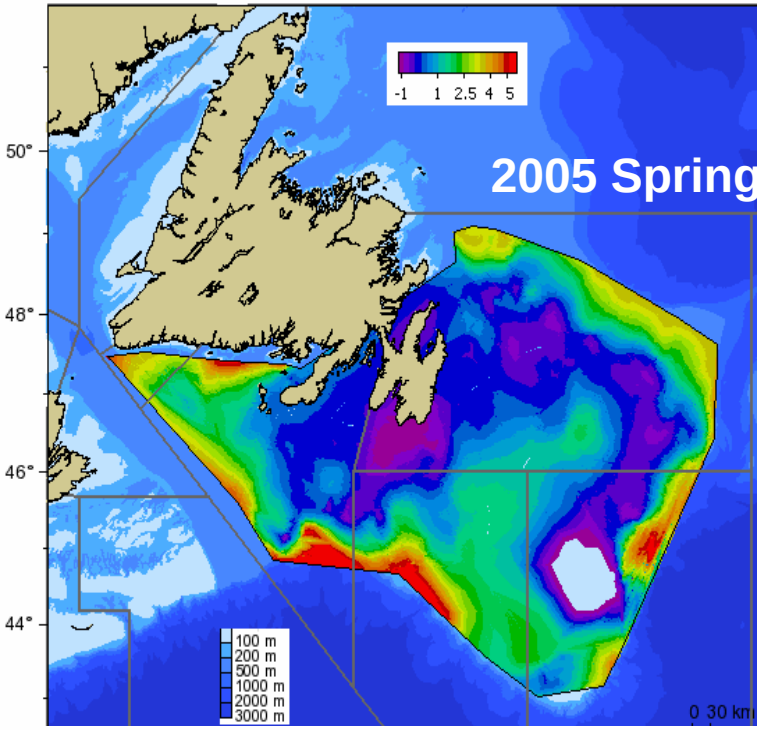
New-shelled

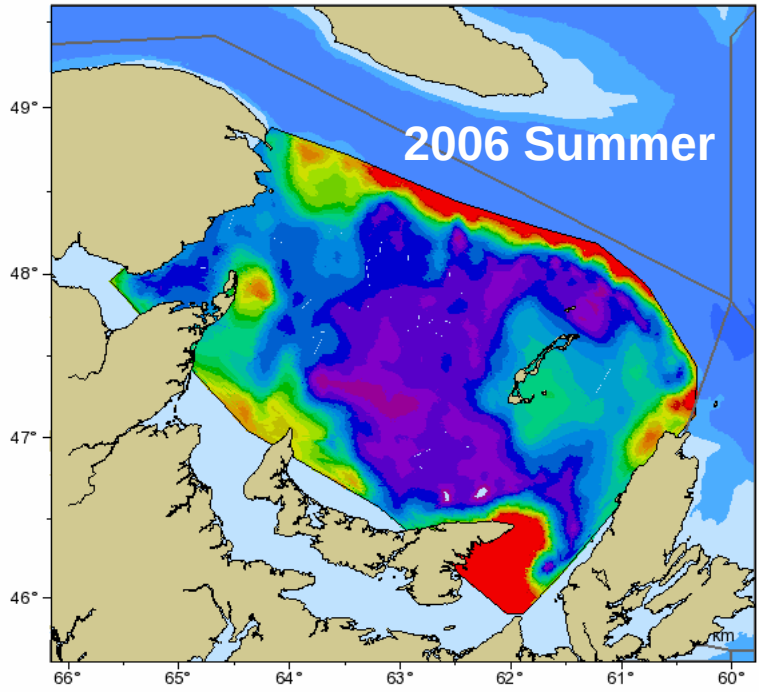
Older-shelled

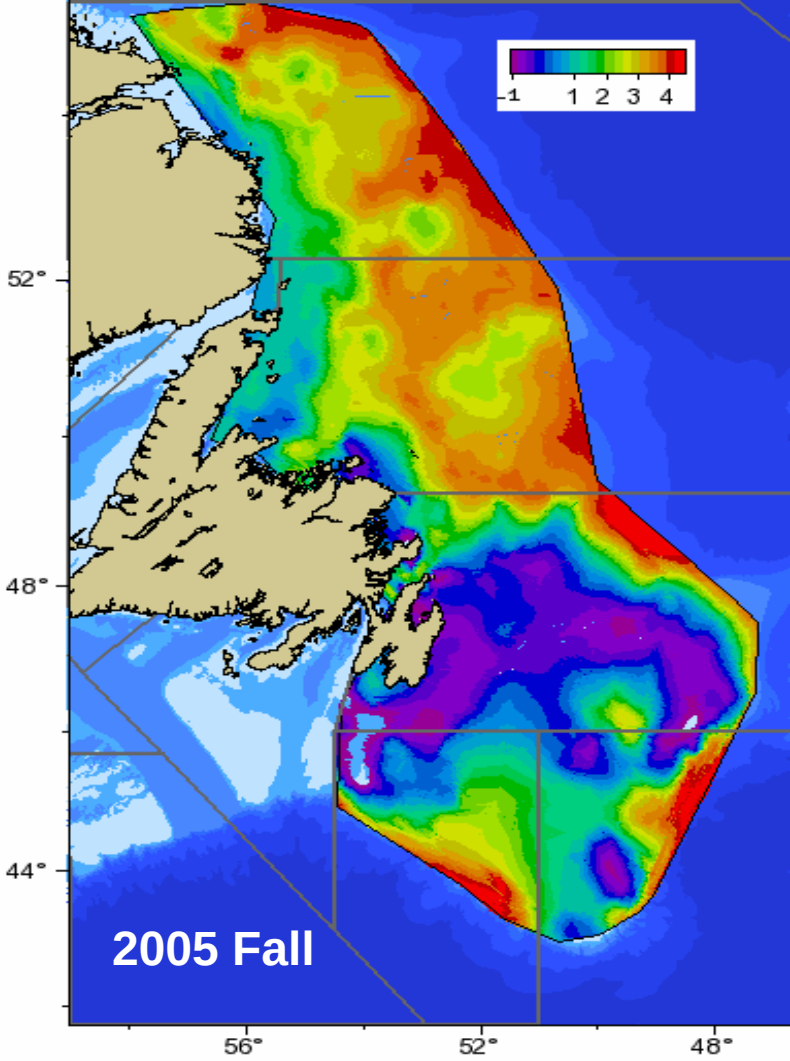


NL Shelf
Div. LNOPs spring
Div. 2J3KLNO fall

nGSL
Div. 4T





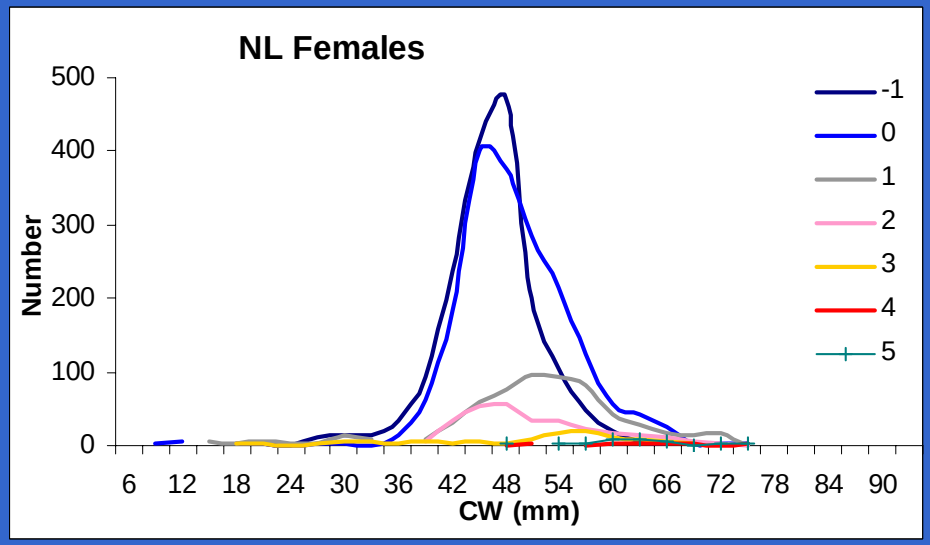


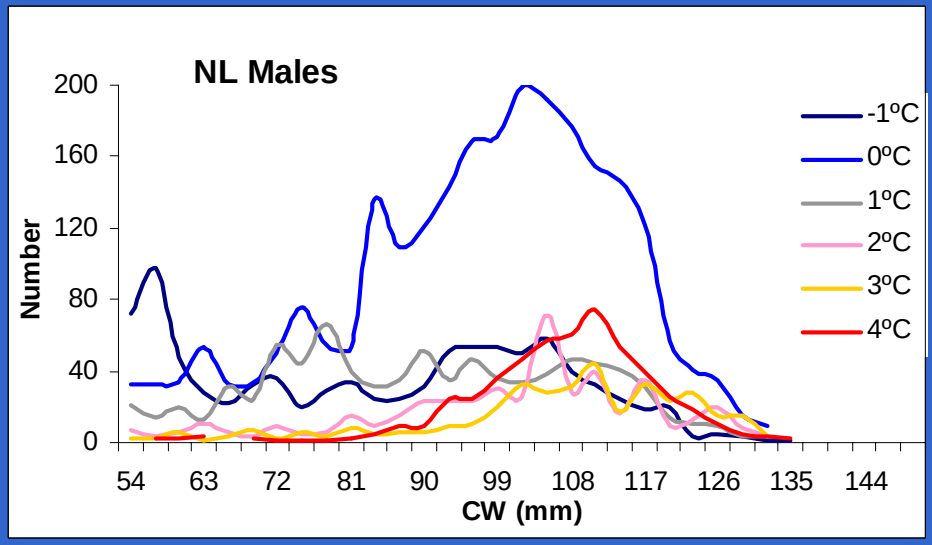
Bottom temperature distributions

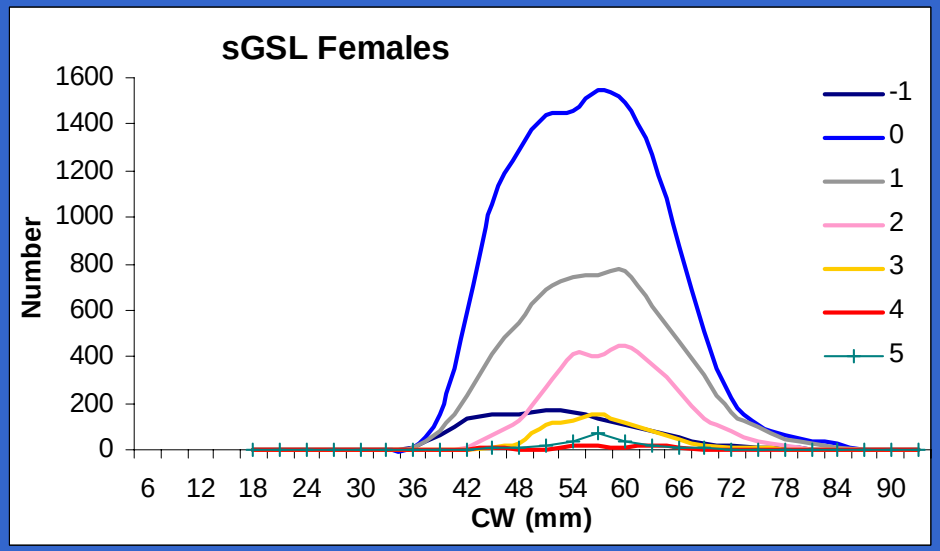
I. Effect of temperature on size-at-terminal molt

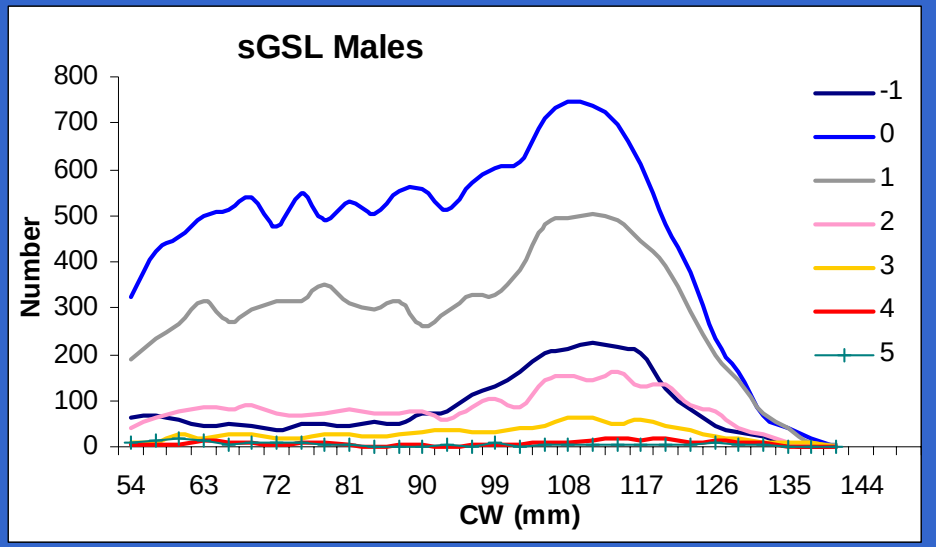
Recently-molted new-shelled males (adult on top, adolescent below)

Sample sizes

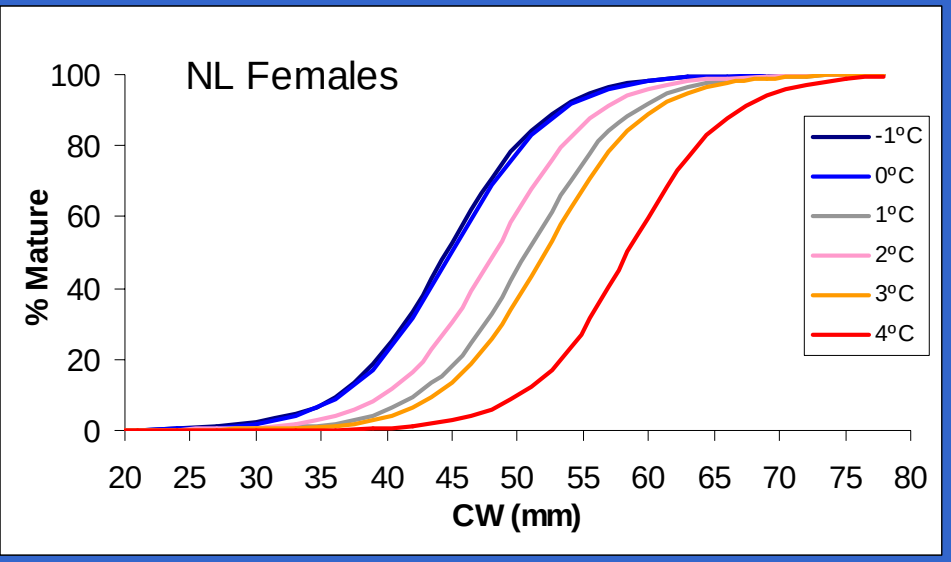


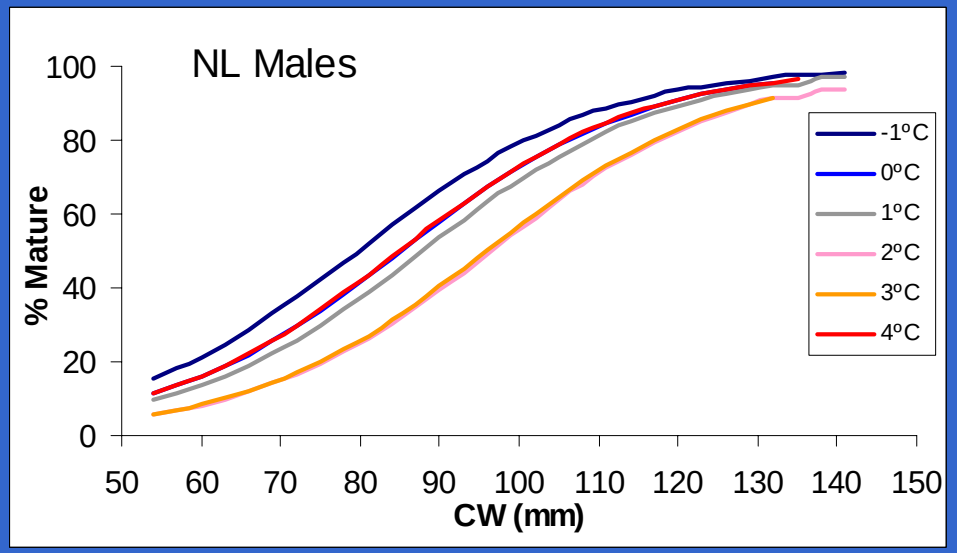


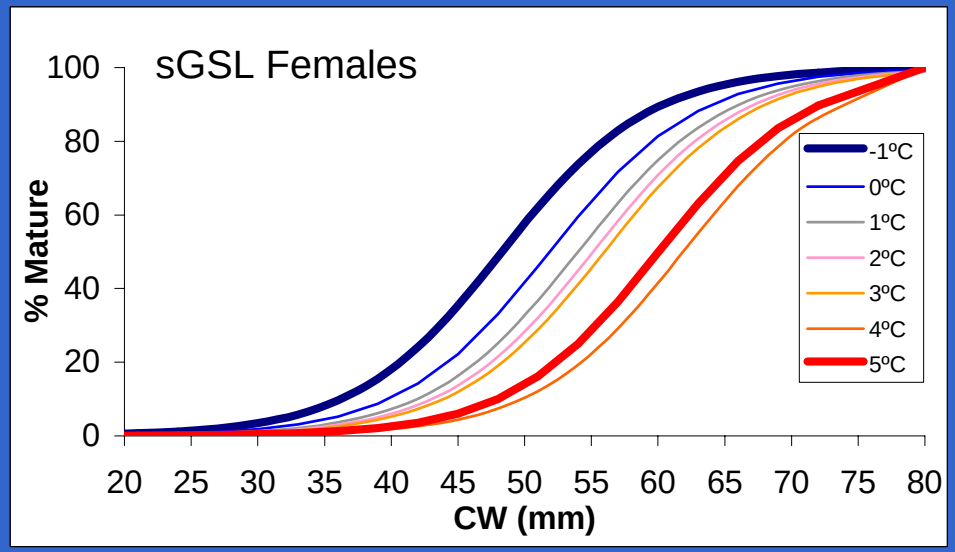


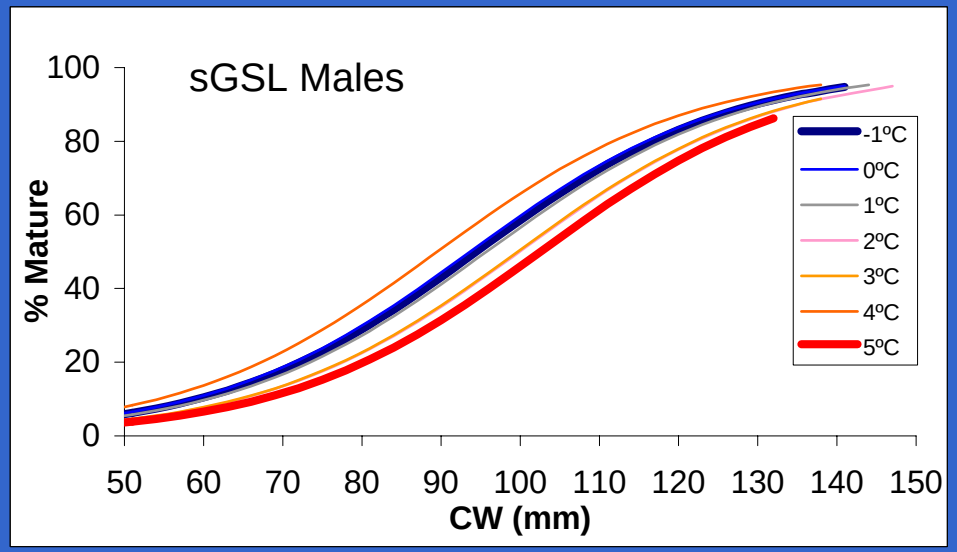


Size-at-terminal molt

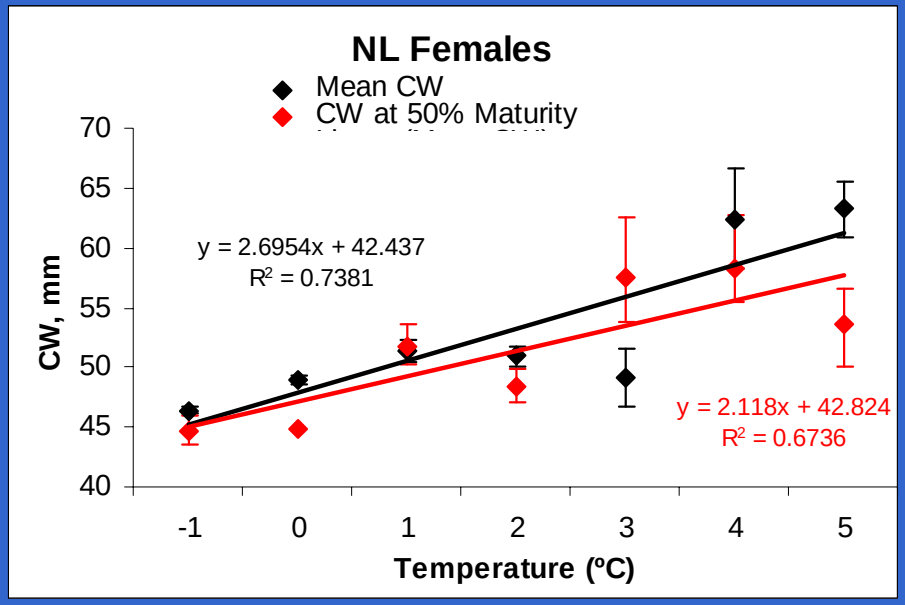


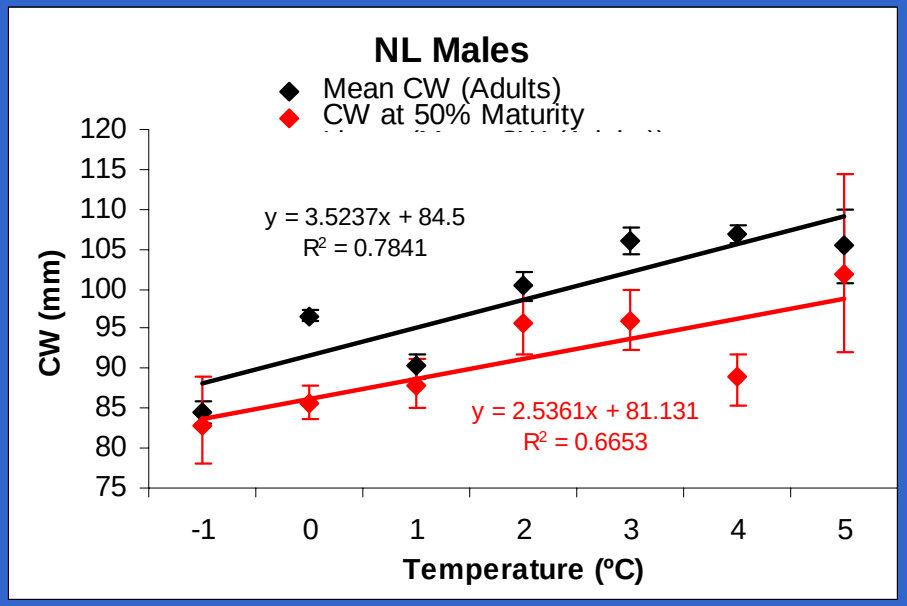


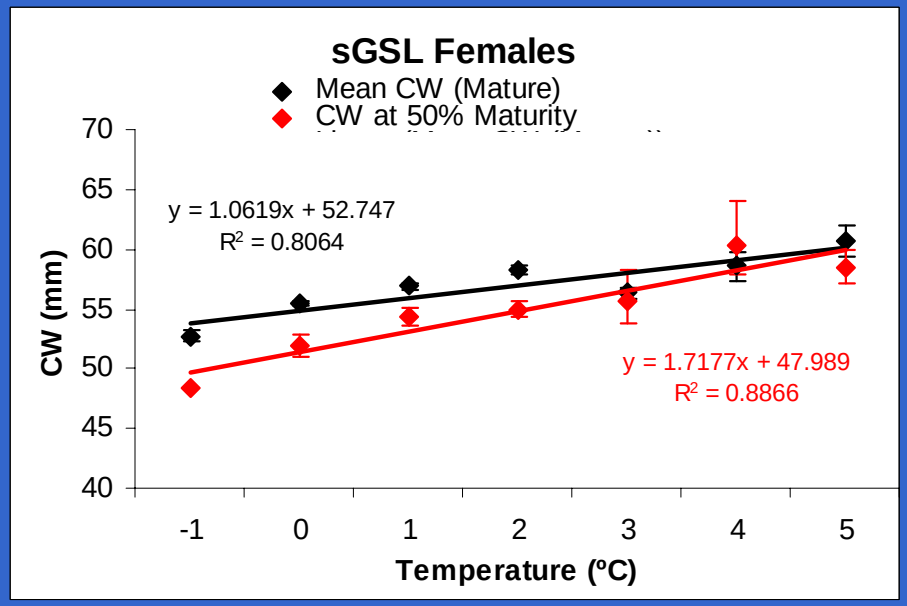


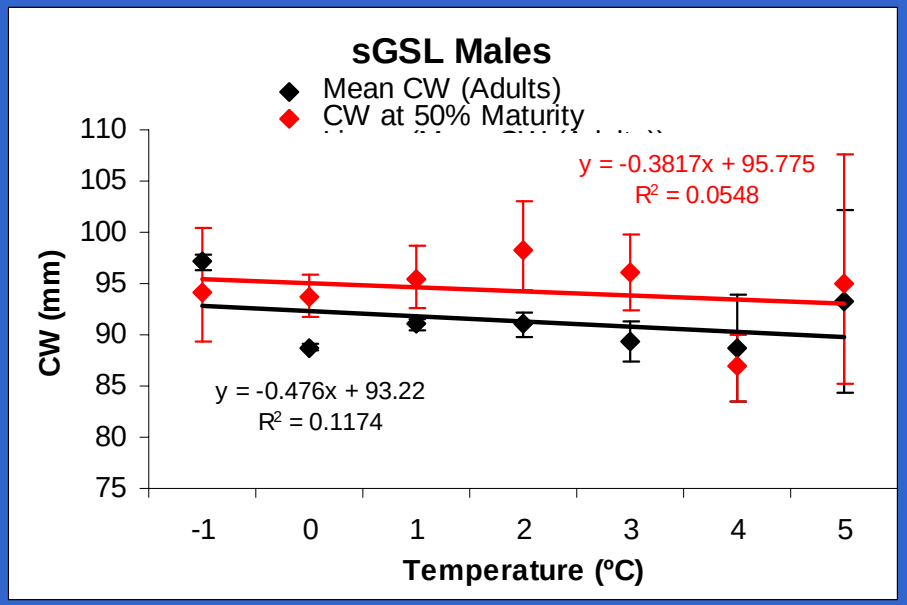


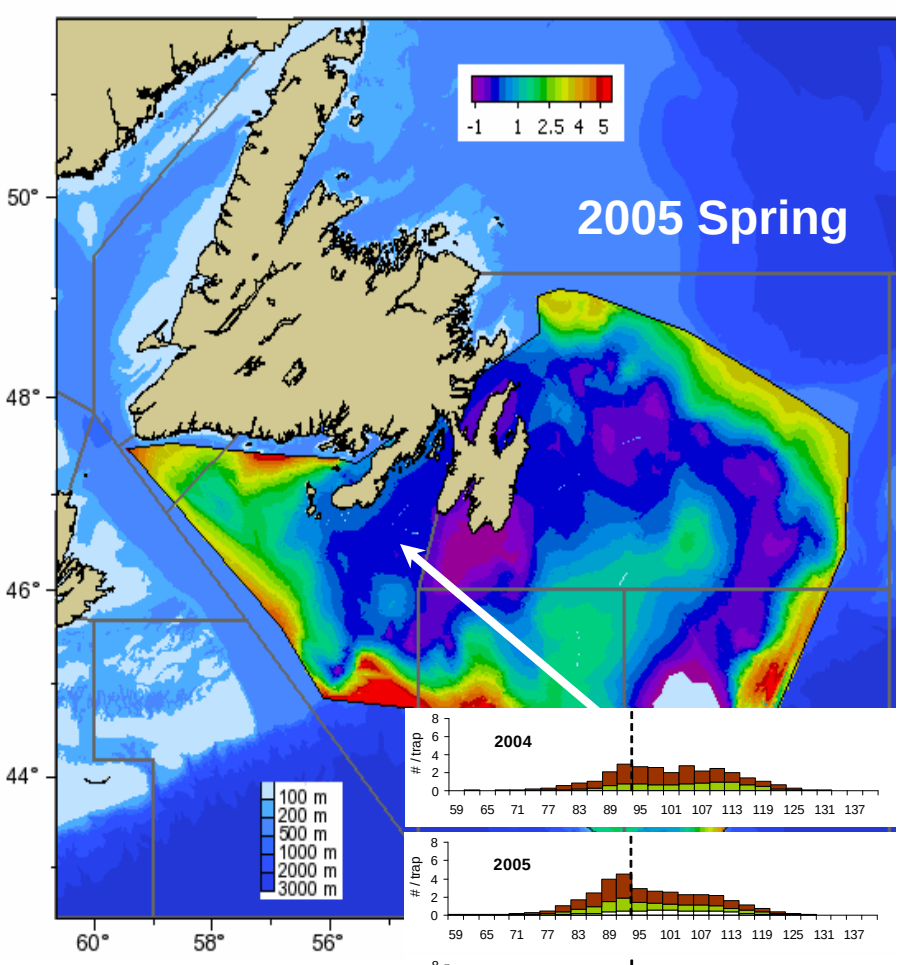
Mean size and Size-at-50% maturity

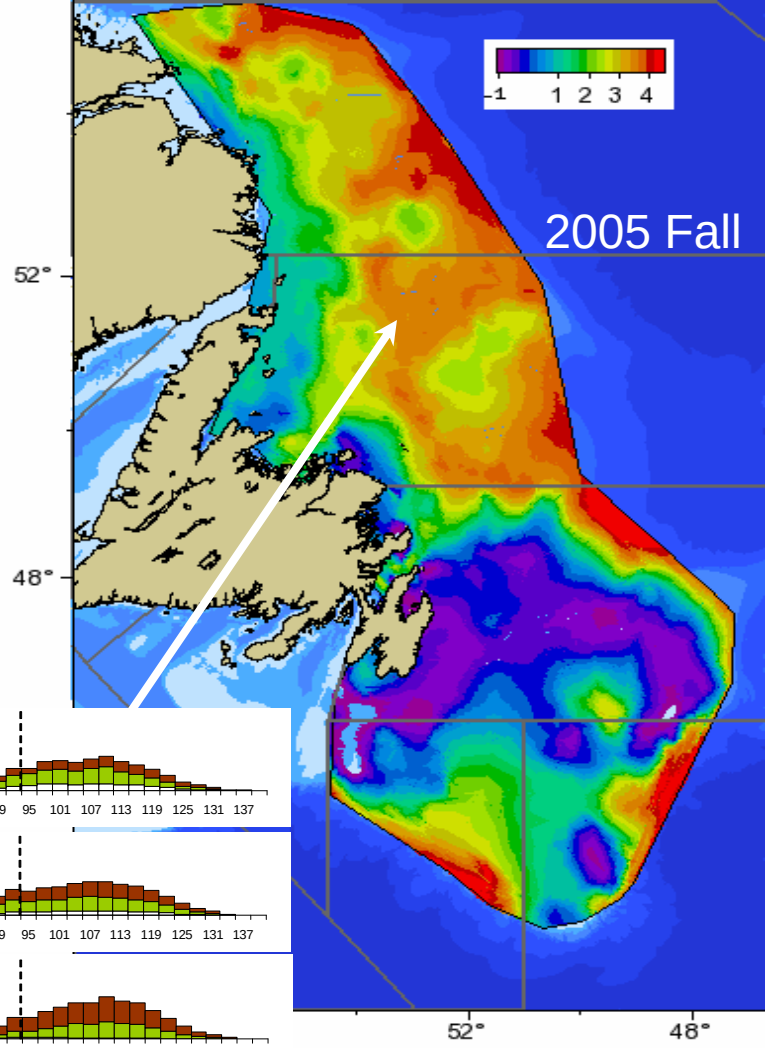


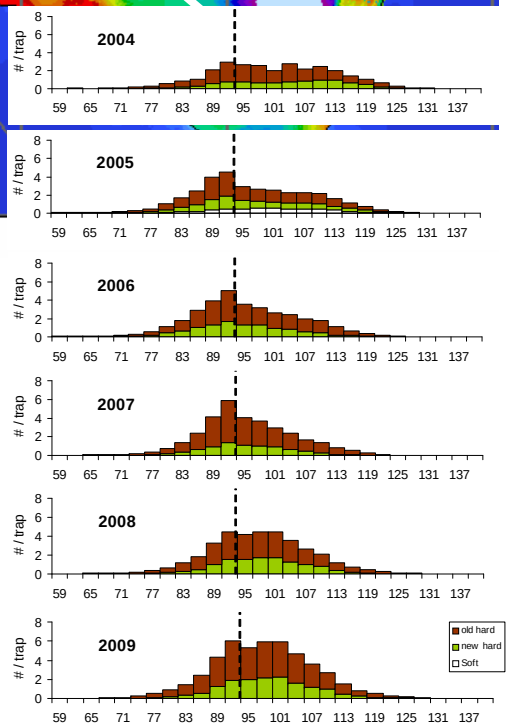


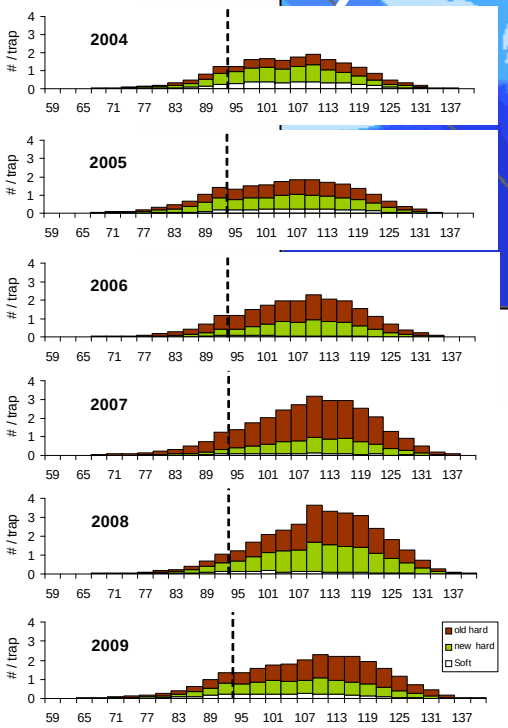





-1 1 2.5 4 5
2005 Spring
50°
48°
46°
44°
60°
58°
56°
100 m
200 m
500 m
1000 m
2000 m
3000 m


-1 1 2 3 4
2005 Fall
52°
48°
52°
48°


2004
2005
2006
2007
2008
2009
/ trap
59 65 71 77 83 89 95 101 107 113 119 125 131 137
old hard
new hard
Soft


2004
2005
2006
2007
2008
2009
/ trap
59 65 71 77 83 89 95 101 107 113 119 125 131 137
old hard
new hard
Soft

Conclusions (Size-at-terminal molt)

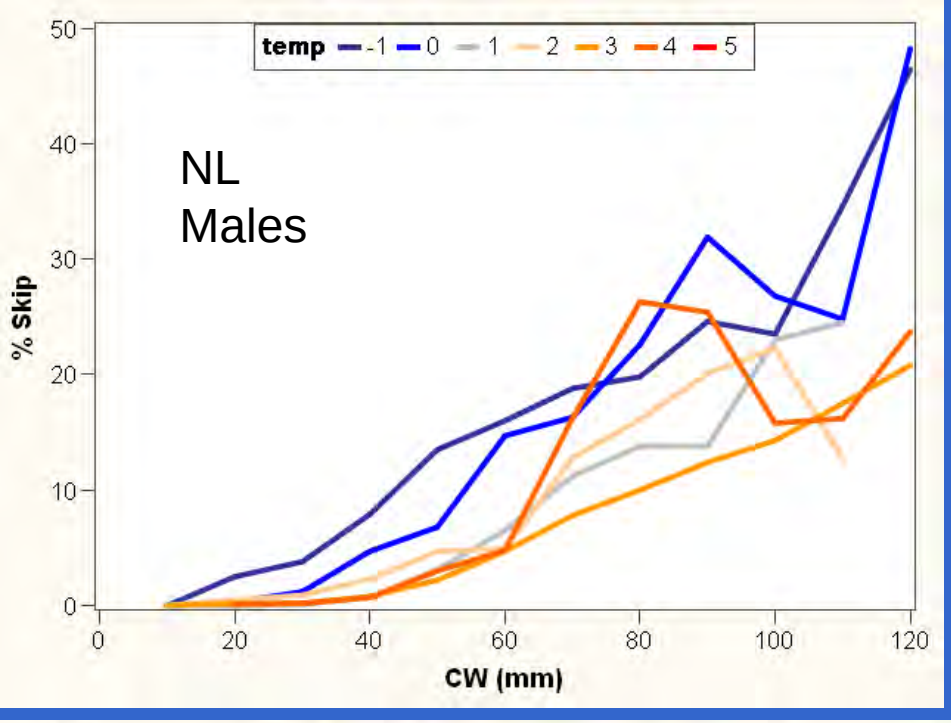
- Temperature has a greater effect on females than males (despite smaller ‘available’ size range) because:

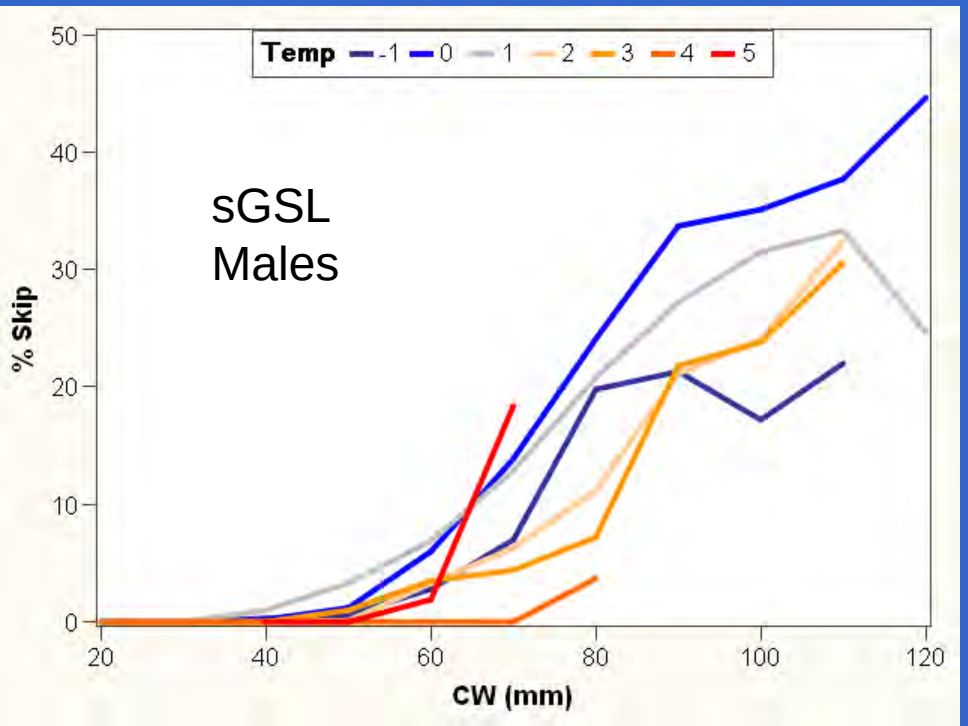
  -the energetic cost of the terminal molt is much higher for females.

  -females are not as migratory as males and so are better conditioned by temperature.
- Temperature effect is clearer at NL than sGSL because:

  - Males at NL, with sharper bathymetry and larger areas of extreme temperatures, are better conditioned by all temperatures than those at sGSL. Temperature-related ontogenetic migrations are likely more pronounced at NL than at sGSL.

II. Effect of temperature on molting frequency (incidence of ‘skip molting’)





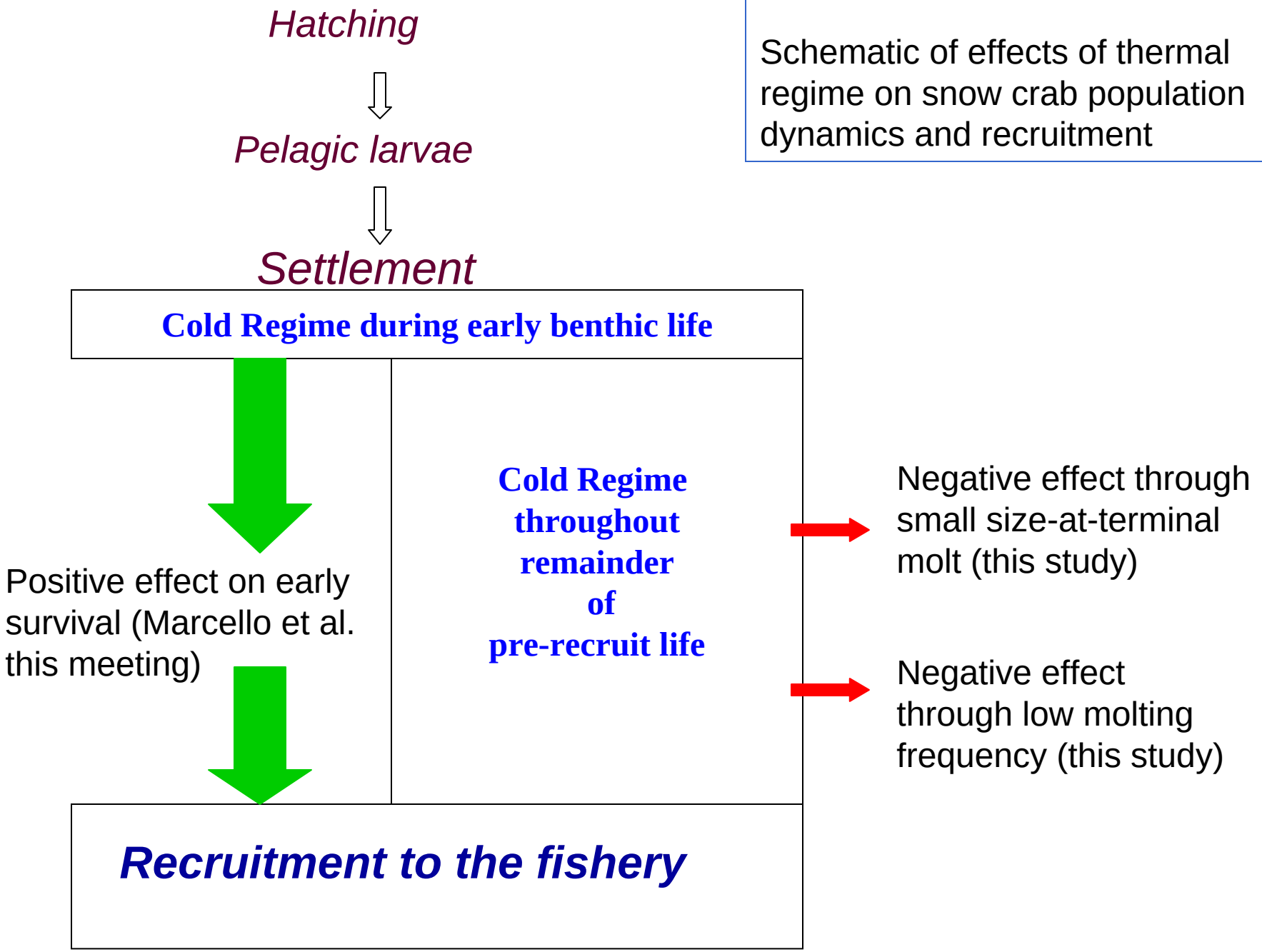
Molting frequency (percentage skip-molting)

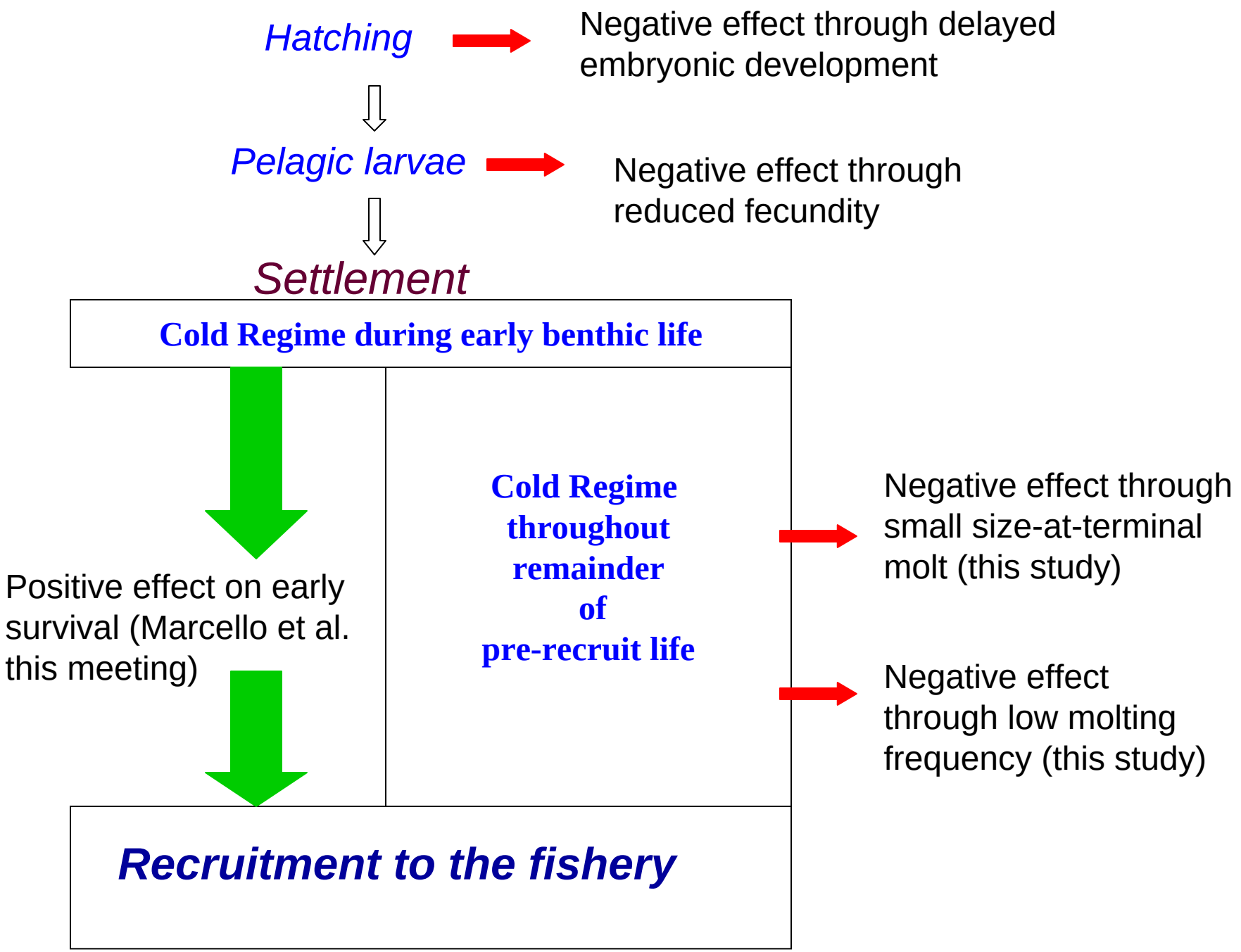
Conclusions (Molting frequency)

- Frequency of molting decreases with size and increases with temperature (highest incidence of skip molting at largest sizes and lowest temperatures)

Conclusion

Schematic of effects of thermal regime on snow crab population dynamics and recruitment




Hatching
Negative effect through delayed embryonic development
Pelagic larvae
Negative effect through reduced fecundity
Settlement
Cold Regime during early benthic life
Positive effect on early survival (Marcello et al. this meeting)
Cold Regime throughout remainder of pre-recruit life
Negative effect through small size-at-terminal molt (this study)
Negative effect through low molting frequency (this study)
Recruitment to the fishery


END