DIET CHARACTERIZATION AND LINK BETWEEN FEEDING SUCCESS AND RECENT GROWTH OF CAPELIN (*Mallotus villosus*) DURING EARLY ONTOGENY

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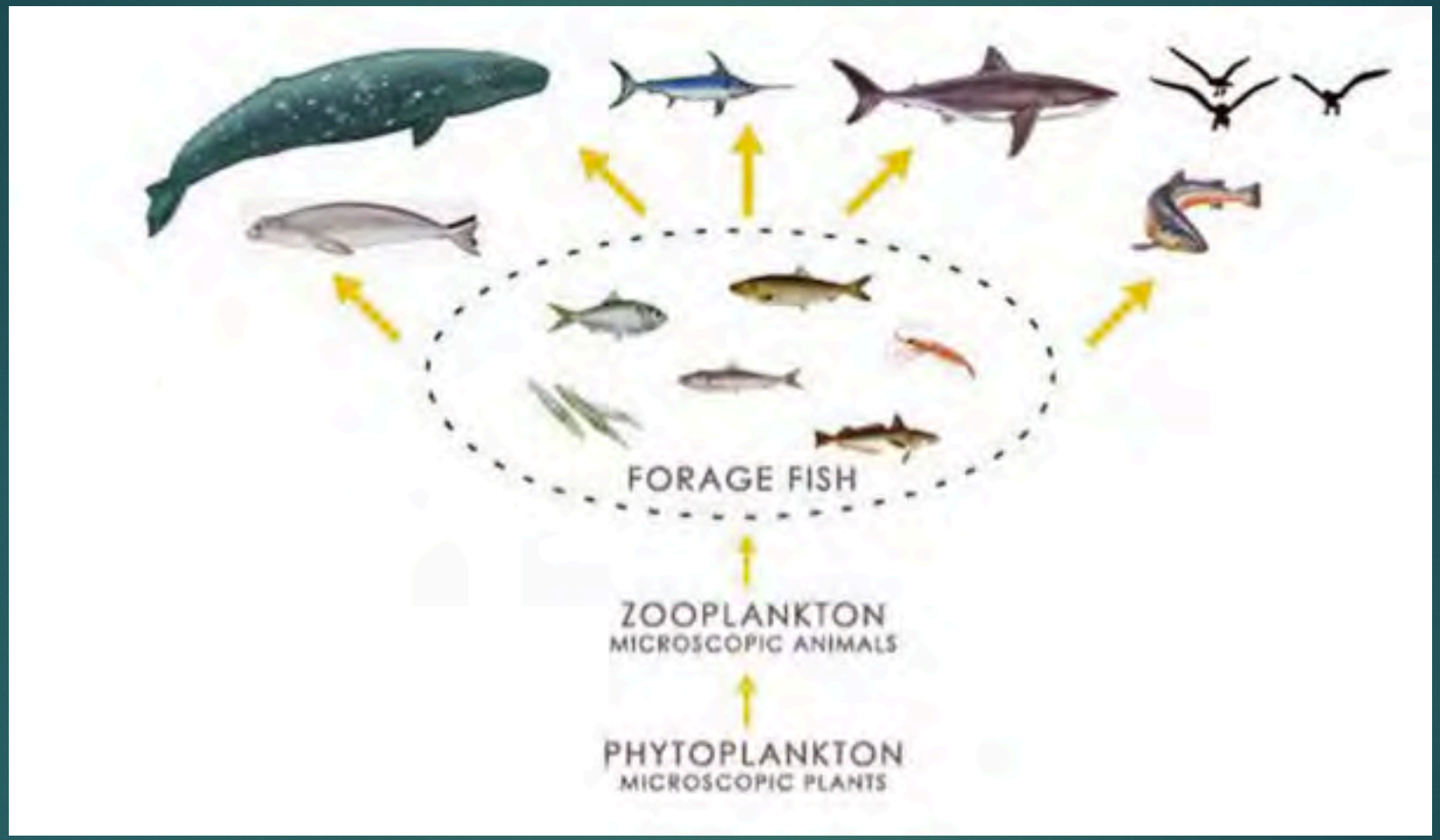
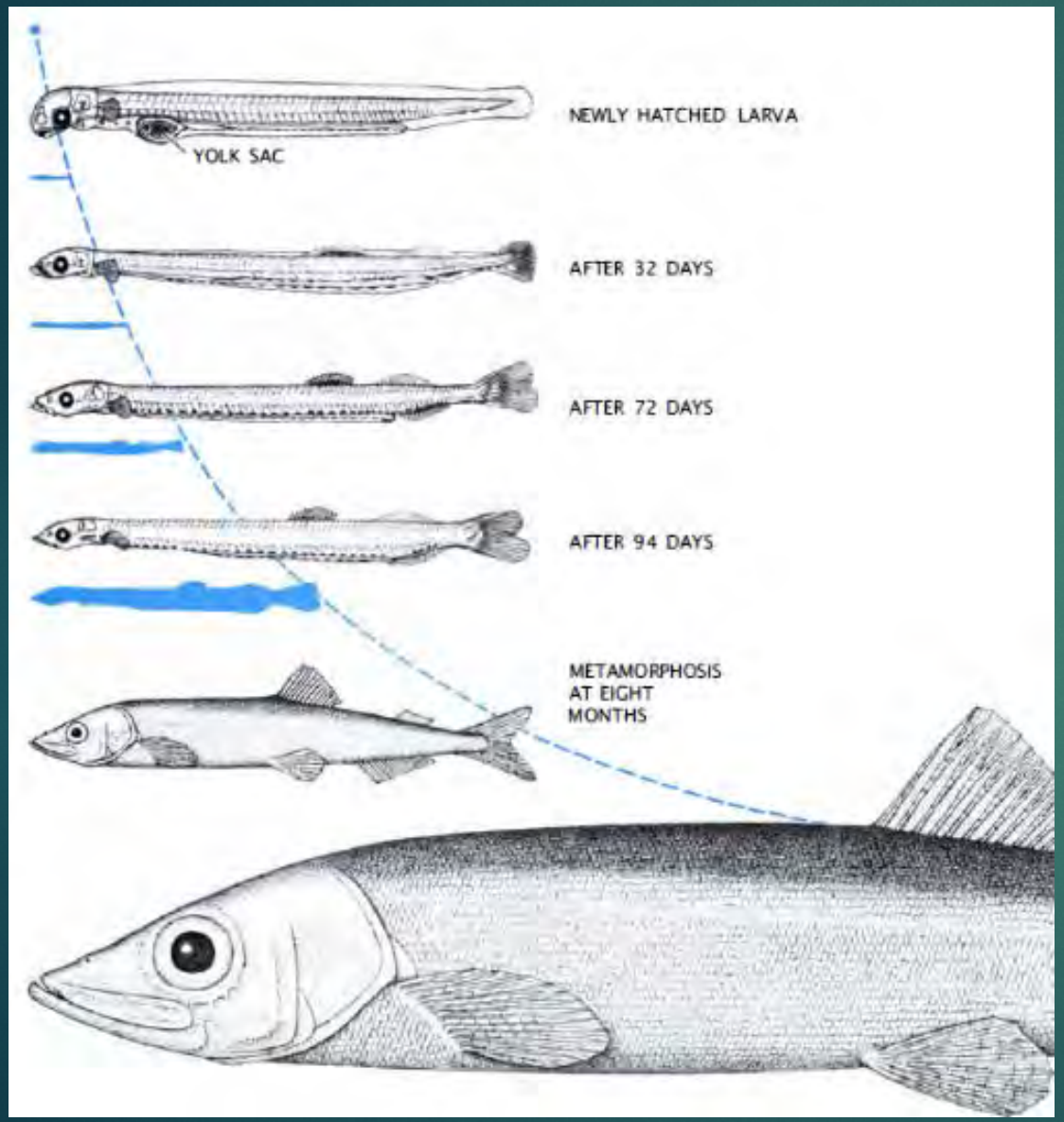
Forage fish



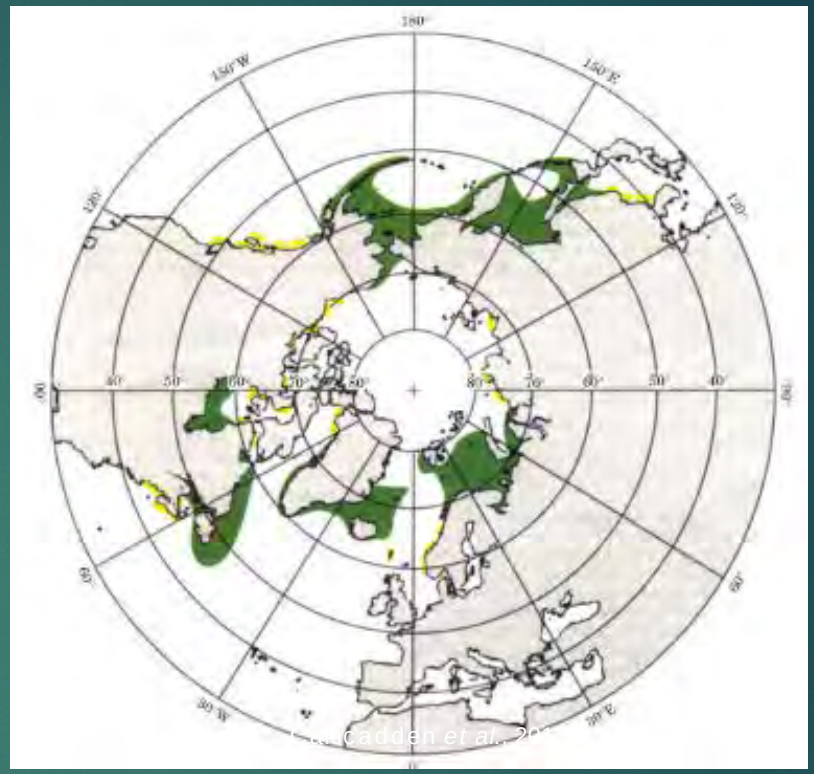
Campbell and Alder (2008); http://grist.org

Forage fish are key component - transfer energy from lower to upper levels of a food web and are susceptible to bottom-up processes (Engelhard et al. 2013).

Capelin (*Mallotus villosus*)



Frank and Leggett, 1991

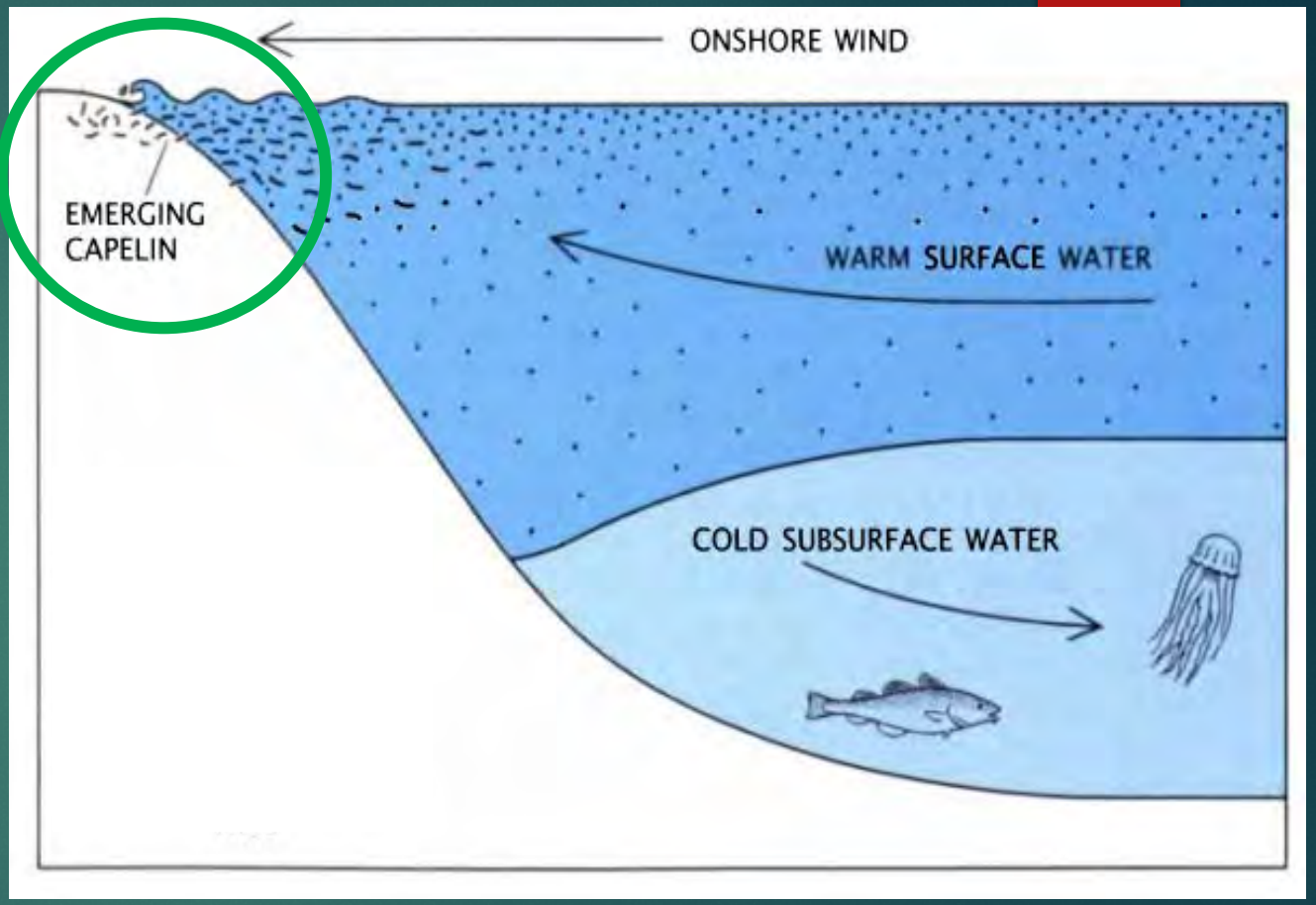


Life cycle: 3 – 6 years

Circumpolar distribution

Capelin (*Mallotus villosus*)

Frank and Leggett, 1991



Frank and Leggett, 1991

Beach and demersal spawning (adhesive eggs)

Capelin larvae emerge with onshore winds – high prey and low predator presence

Newfoundland capelin

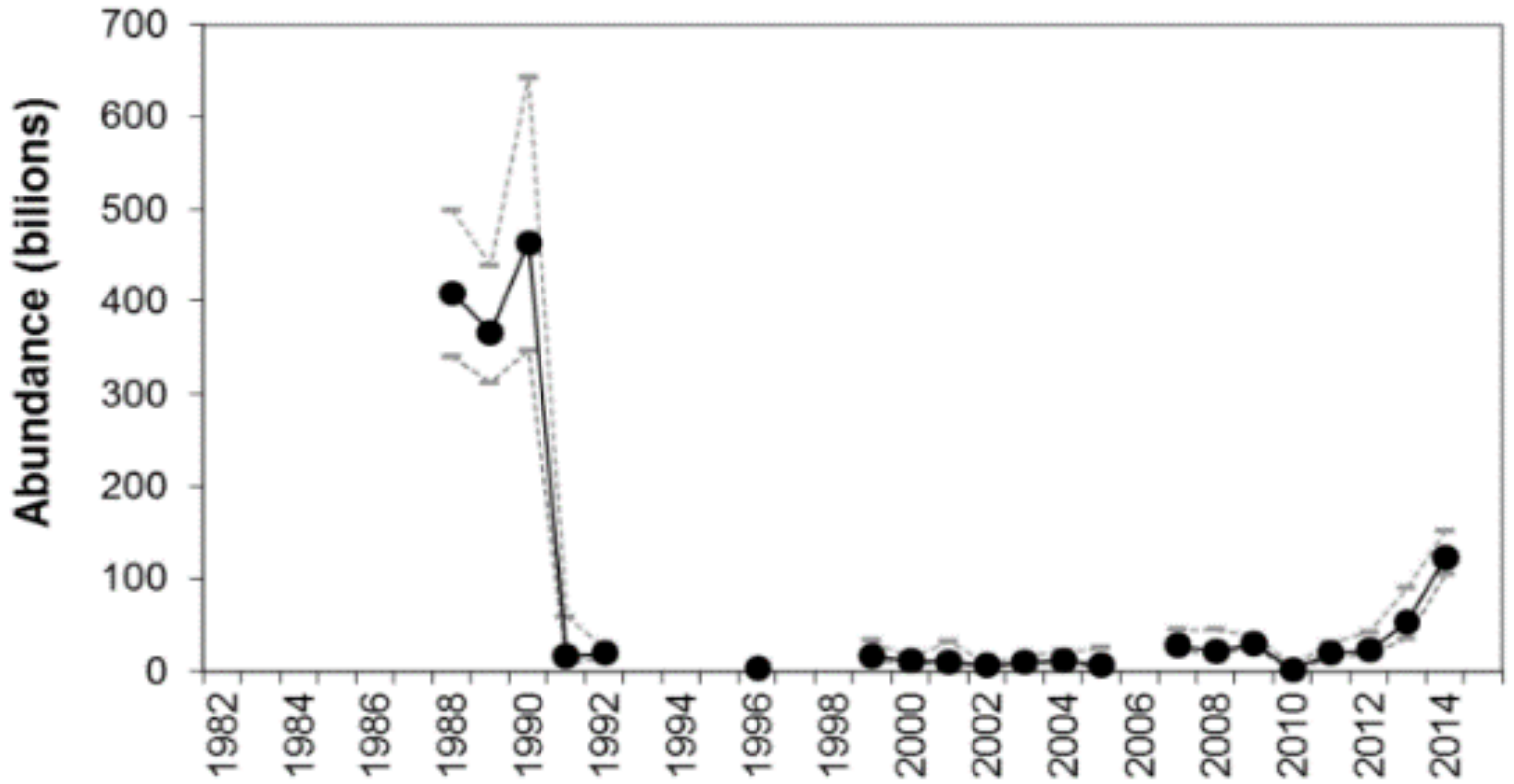


Figure 4. Index of offshore capelin abundance (line) with 95 % confidence intervals (broken lines) for an index area (mostly NAFO Div. 3L).

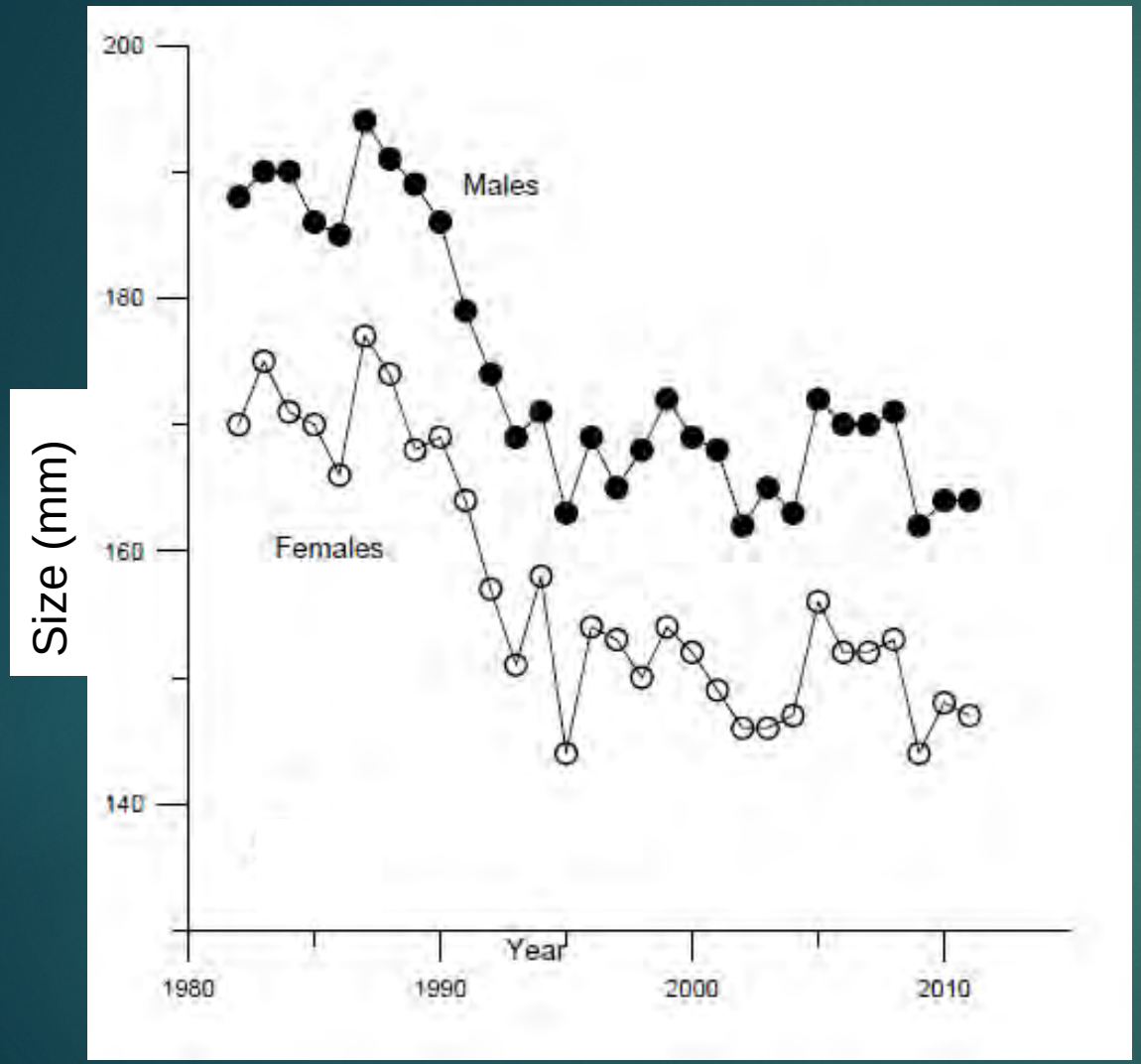
DFO, 2015

Stock collapse in the early 1990's

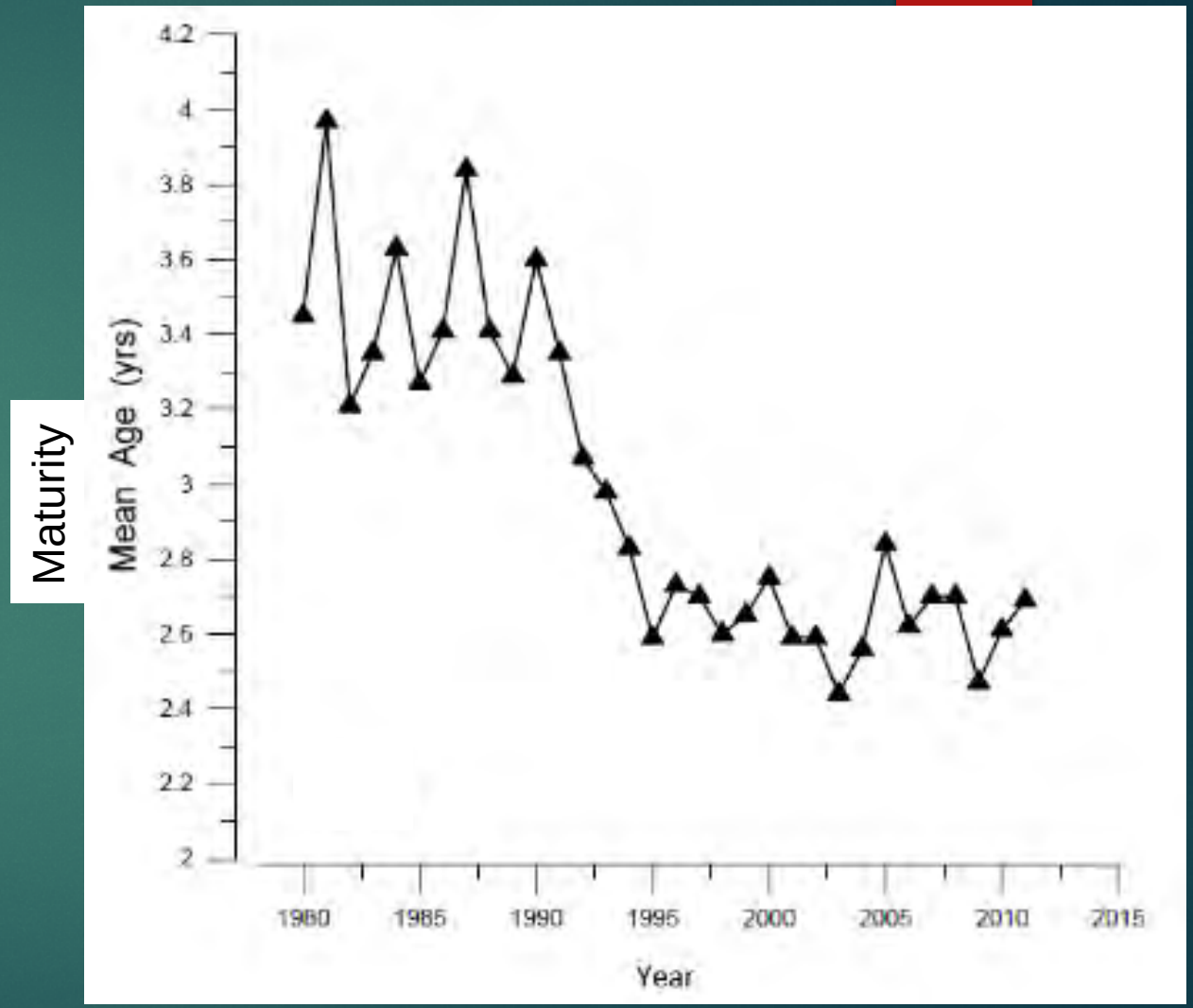
Decline of predatory groundfish

Minor fishery exploitation

Newfoundland capelin

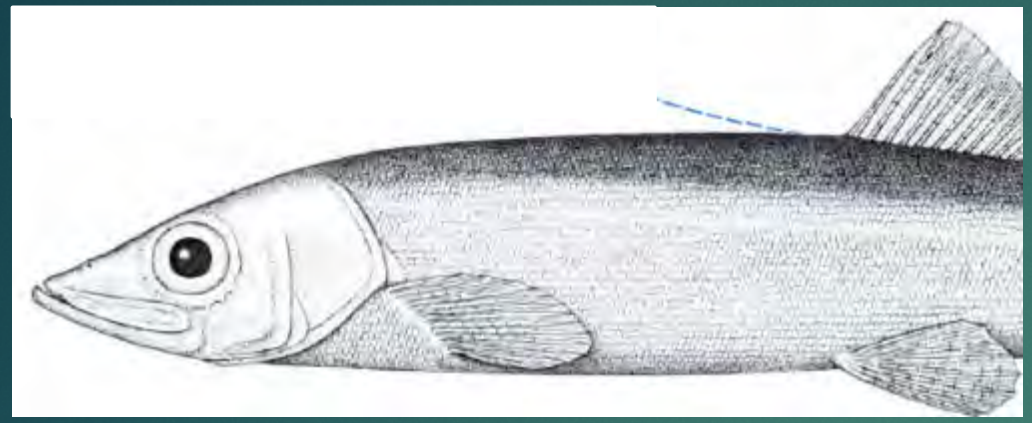


DFO, 2015



DFO, 2015

Fish recruitment



Larval growth has been shown to be one of the main factors regulating fish recruitment

Feeding success relative to prey availability and quality regulate larval growth

Match-mismatch hypothesis (Cushing 1990)

Bigger-is-better hypothesis (Houde, 1987; Miller et al. 1988)

Growth-predation hypothesis (Anderson, 1988)

Capelin larval diet

Prey are of 90-130 µm size range (Leggett *et al.*, 1984; Taggart and Leggett, 1987).

Capelin larvae feed primarily on copepods from different stages (Pepin and Penney, 1997; Vesin *et al.*, 1981).

Baker et al. 2013

Fish larvae are prey species selective

Capelin larval diet at a higher taxonomical resolution has yet to be described

Capelin larval diet

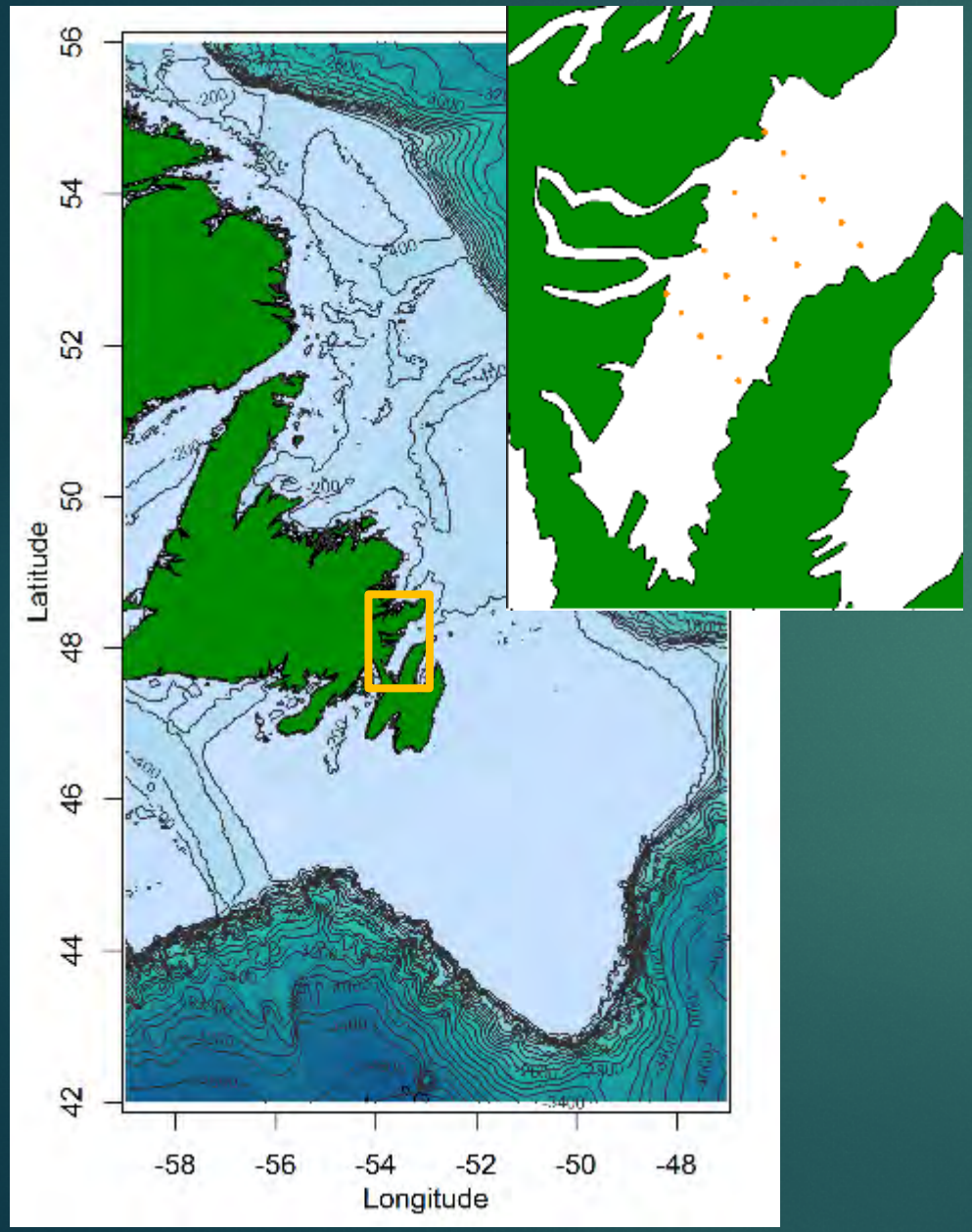
Baker et al. 2013

Hypotheses:

Selective feeding through ontogeny (Trophic niche breadth)

Interannual variability in capelin larval diet composition linked to relative abundance of potential prey

Methods



Samples of this area surveyed by Fisheries and Oceans Canada (DFO)

Trinity Bay, Newfoundland - CCGS Vladykov

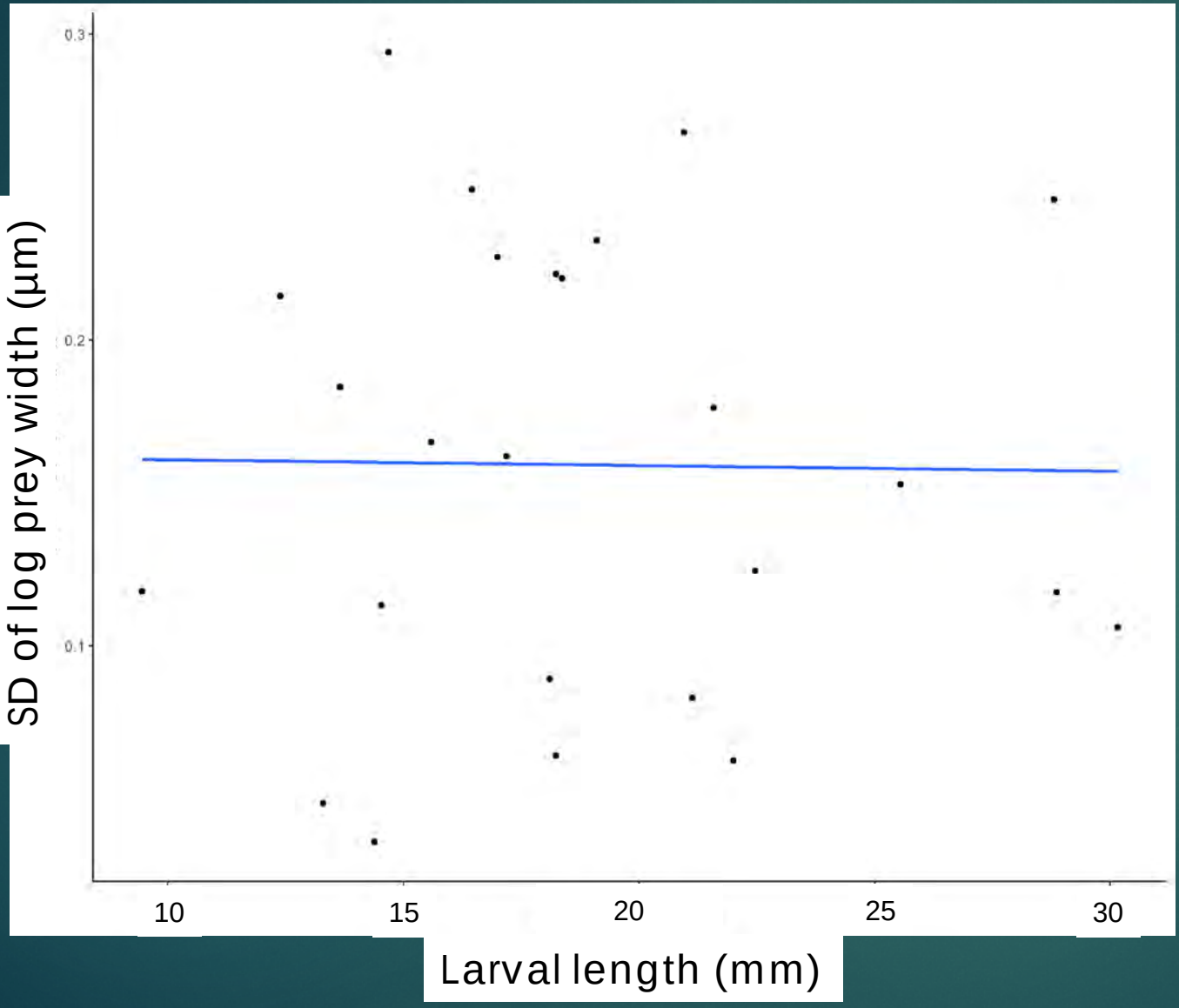
Oblique bongo tows with 333µm mesh nets

2002, 2006 and 2014

Samples from bongo tows - preserved in ethanol

Capelin larvae identified and dissected for gut content identification under dissecting microscope(80x)

Capelin larval diet – Trophic Niche Breadth

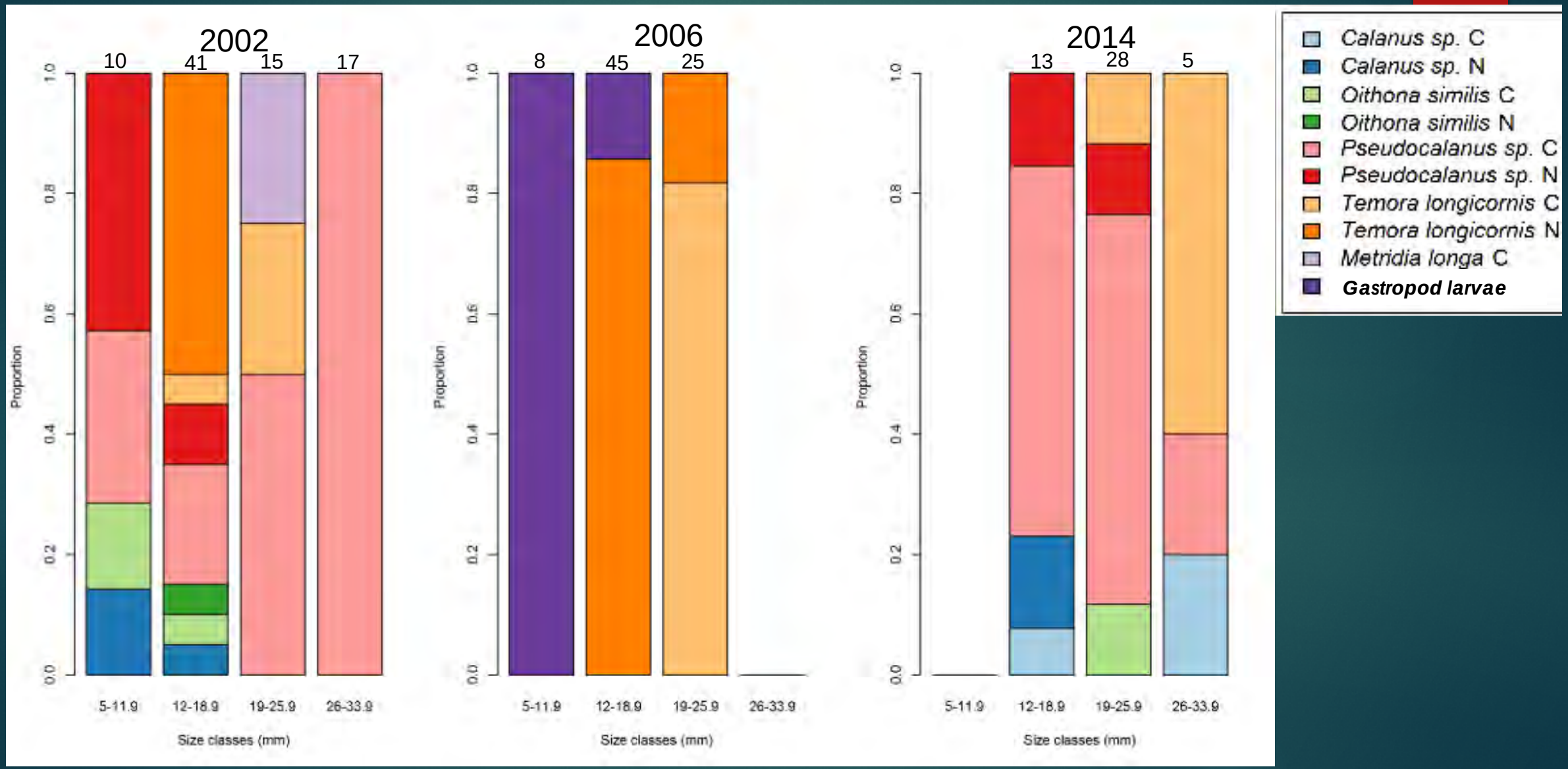


Variability of prey sizes ingested by capelin larvae (SD of log prey width)

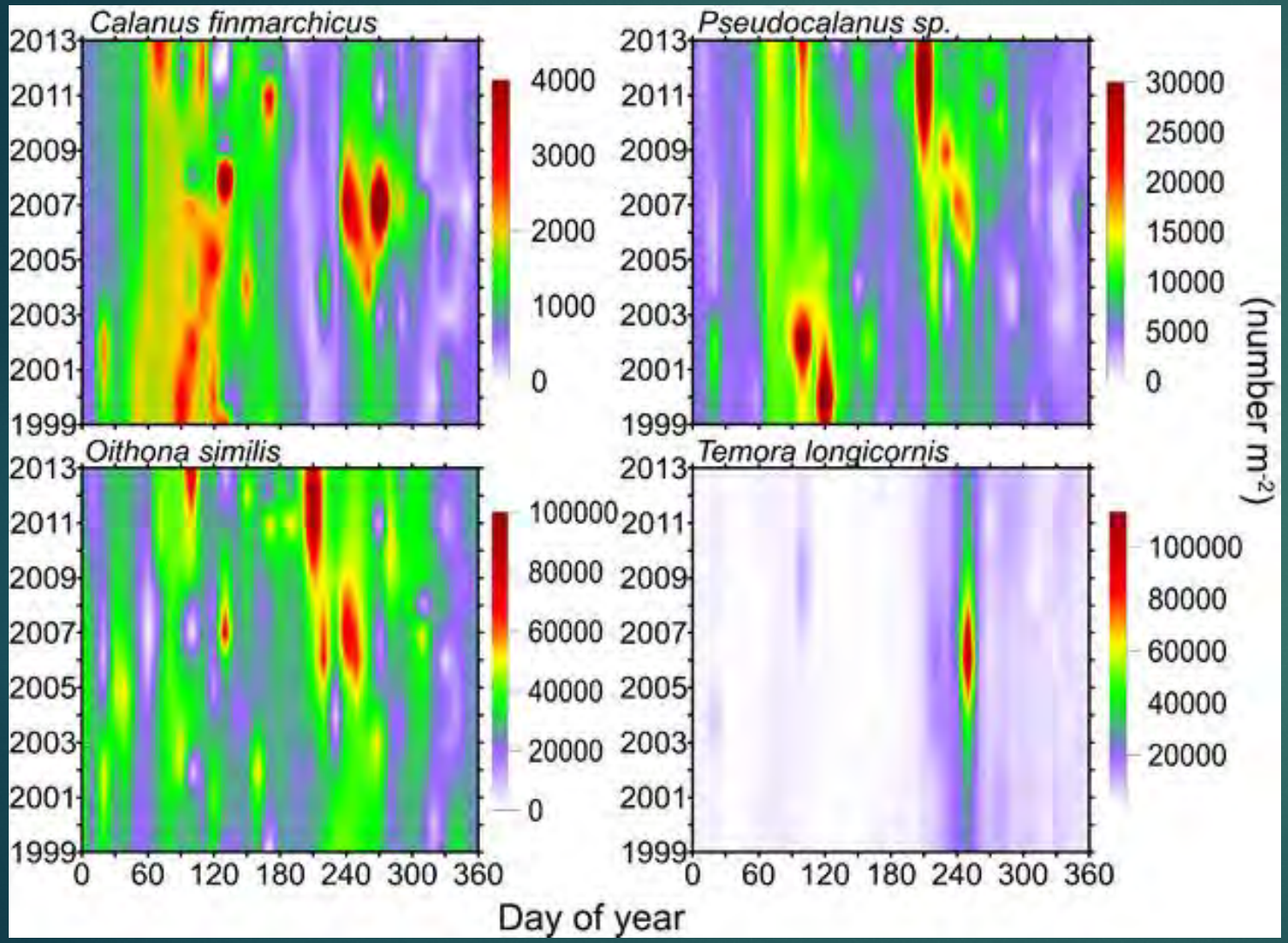
Stable, non-significant ($p>0.05$)

Capelin larvae present selective feeding through ontogeny

Capelin larval diet



Larval prey abundances



Wilson, 2017

Larval prey abundances from Atlantic Zone Monitoring Program (AZMP)

T. longicornis peaks during the fall and mid 2000s in particular

Pseudocanalus sp. peak during the fall from 2006 onward

Summary

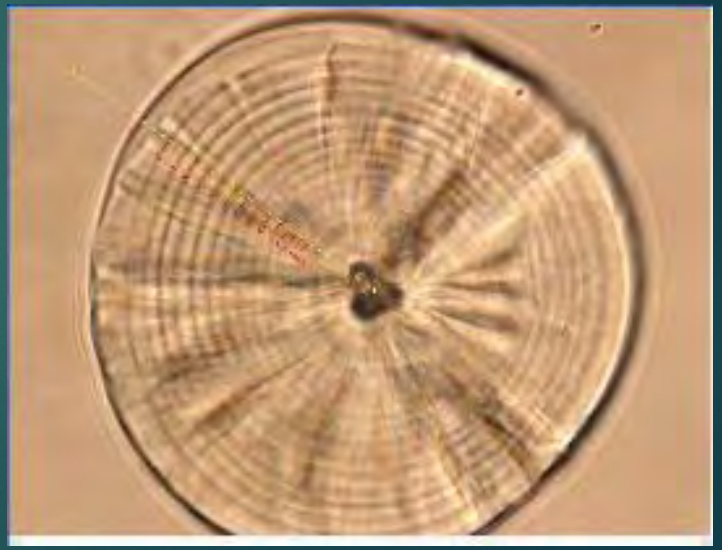
- Smaller larvae (<19 mm) were feeding primarily on nauplii stages of *Pseudocalanus* sp.
- A notable exception was observed in 2006 when *Temora longicornis* was the main prey, which corresponded to an order of magnitude increase of that copepod
- Larger larvae (>19 mm) ingested mainly copepodite stages of *Pseudocalanus sp.*
- There was no relationship between trophic niche breadth and larval length, suggesting selective feeding
- Size is known to be the main factor driving prey selectivity in marine systems. At similar prey size, species specific differences in behavior are also an important driver of prey selectivity.
- In agreement with Ivlev (1961) review on fish feeding dynamics, our results suggest that a switch in prey selectivity occurred following a drastic decrease in relative abundance of the traditional preferred prey. This could have important implications on larval dynamics and survival.

Next steps - recent growth

To study the influence of the switch in prey on larval recent growth

Detrended growth rate will be used to take into account the increase of growth variability with larval size

$$DG_{ij} = (G_{ij} - G_j)\, SD_j^{-1}$$



Recent growth is defined as the last 3 ring depositions before the edge of otolith

We would expect a statistically significant relationship between diet composition, feeding success and recent growth

Acknowledgments

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