

Climate effects on maturation and spawning of Atlantic cod and implications for fisheries

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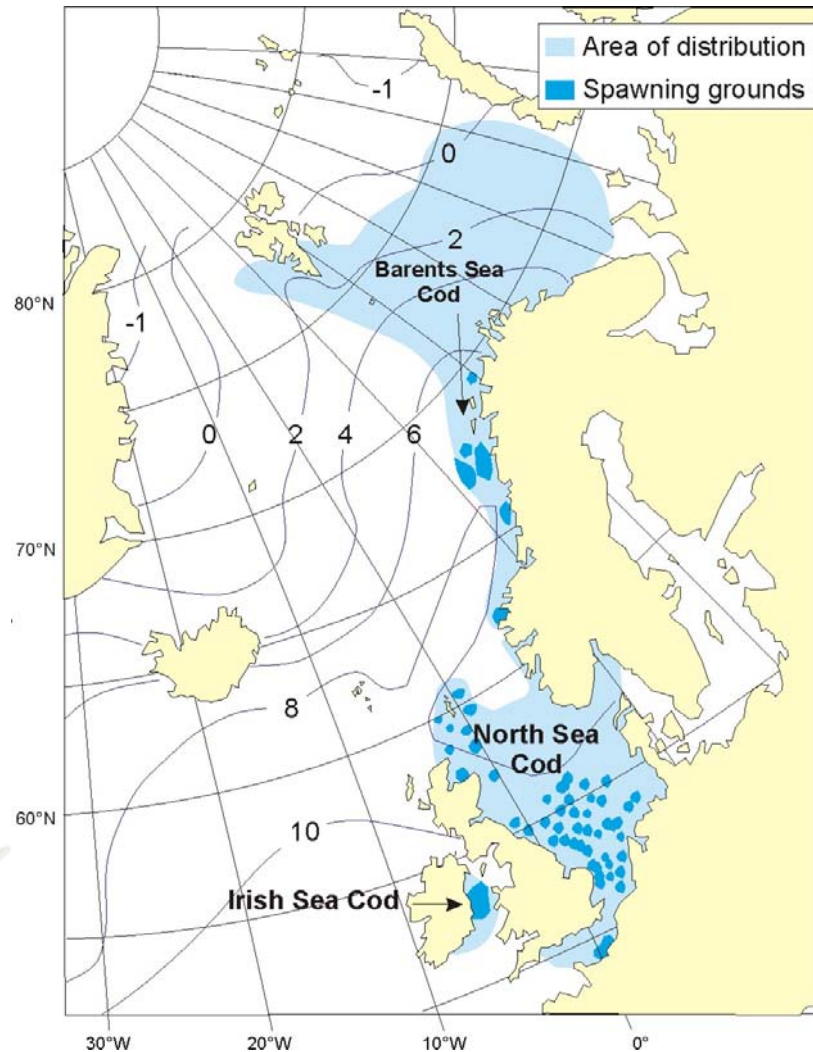
³Cefas, Lowestoft, UK

this talk

- **Background information:** physiological principles for regulation of spawning time (cf. Kjesbu et al. 2010.CJFAS)
- **Simulation exercises** in a ‘warming situation’:
 - size-specific spawning time (maternal effects)
 - recruitment implications (match-mismatch theory)
 - size-specific harvesting of spawners
- **Conclusions**



stocks considered



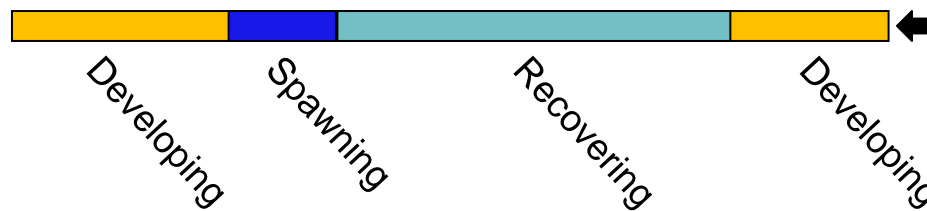
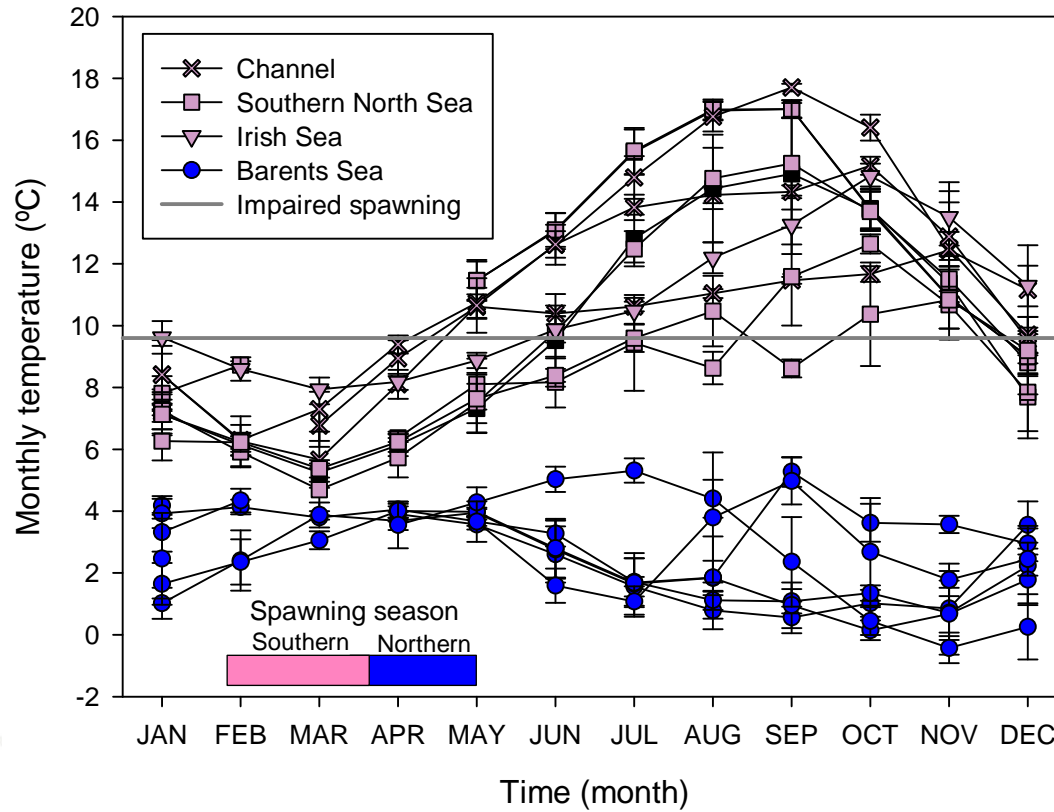
Redrawn from Sundby (2000)



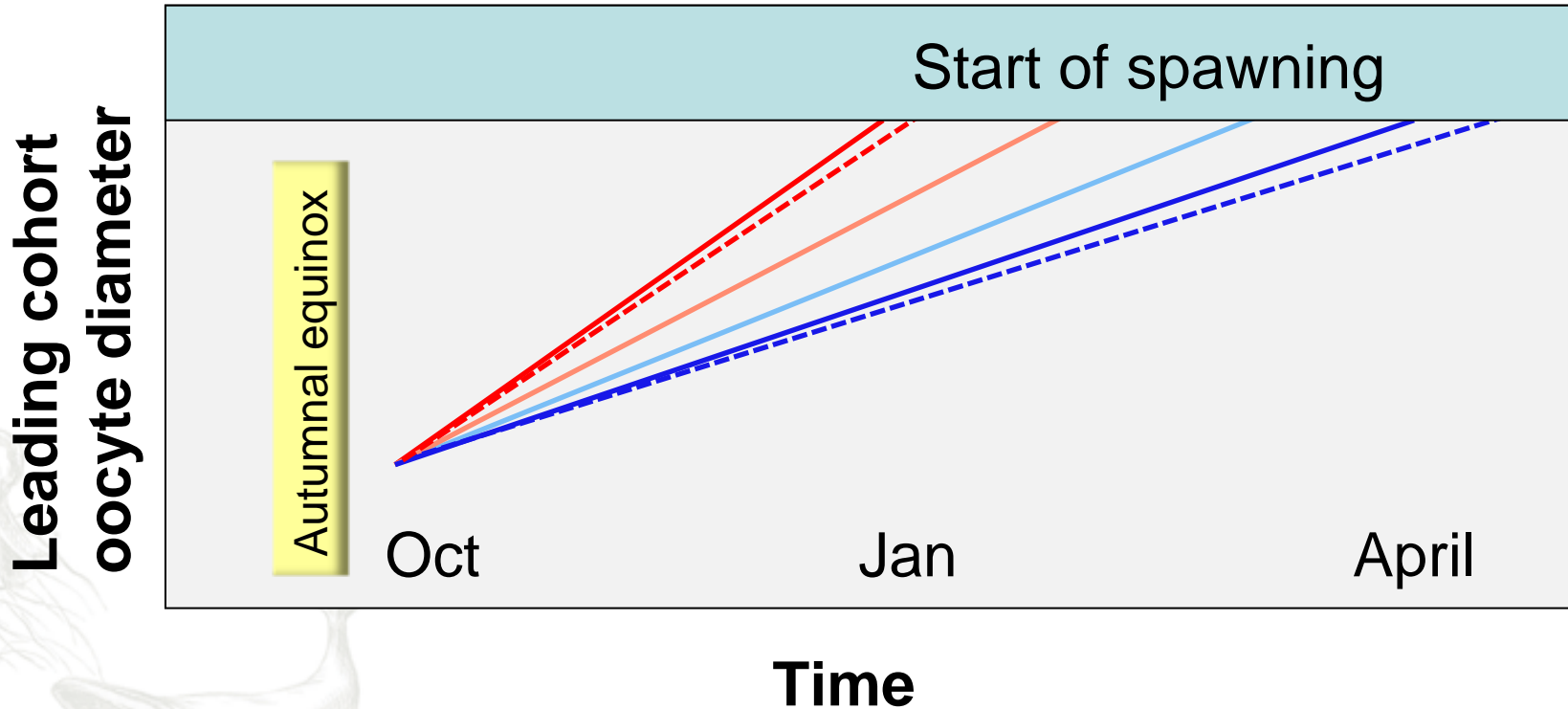
background information



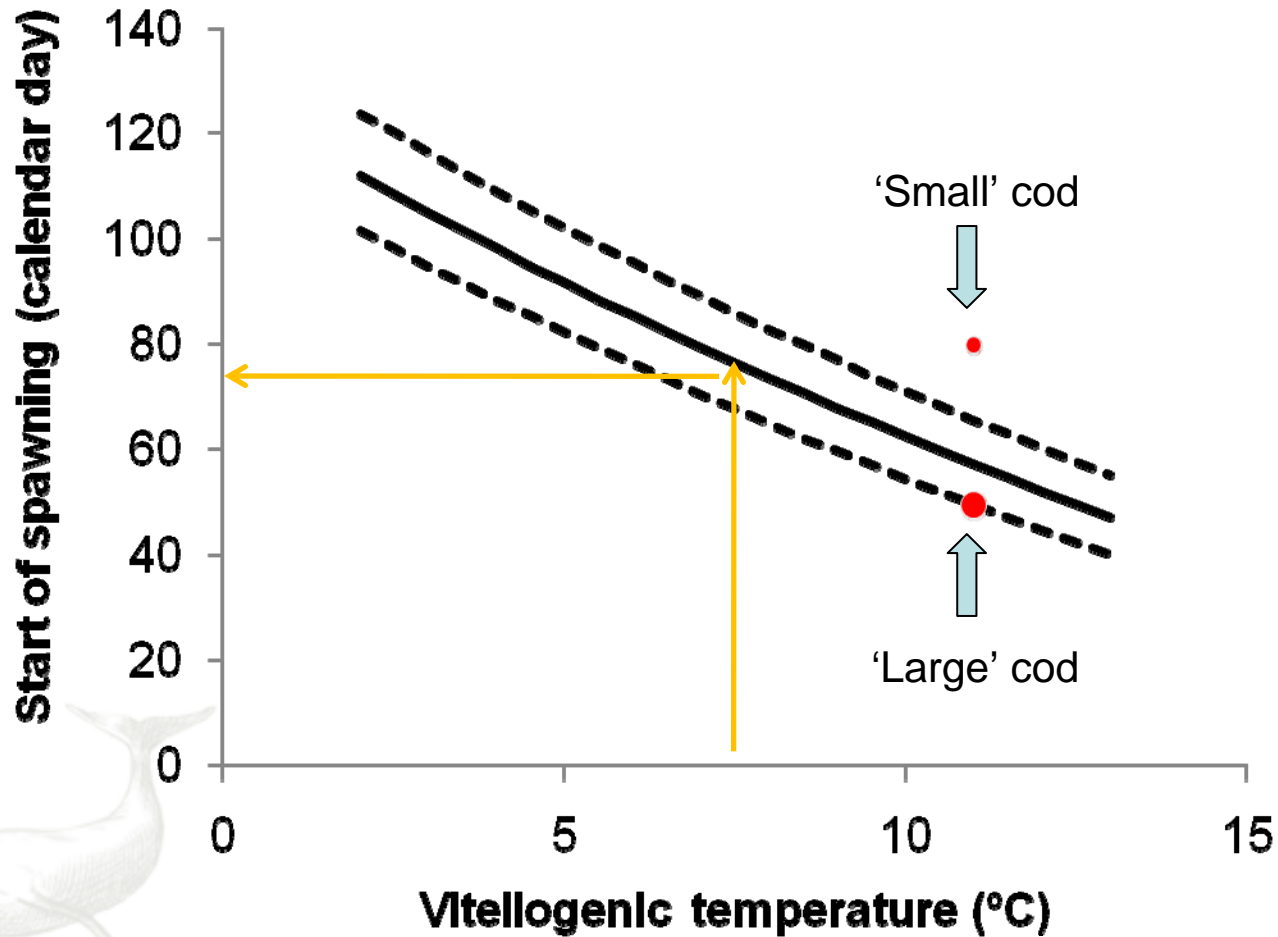
in situ environmental temperature data storage tags



maturity development vs light cycle, temperature and fish condition



general model for start of spawning vs temperature



size-specific maturity development field results

- Irish Sea cod: **yes**
- North Sea cod: **yes**
- Barents Sea cod: **now and then**; 3 out of 8 recent years





The Lofoten fishery



Pointer 68°06'29.91" N 29°21'26.55" E

Streaming ||||| 100%

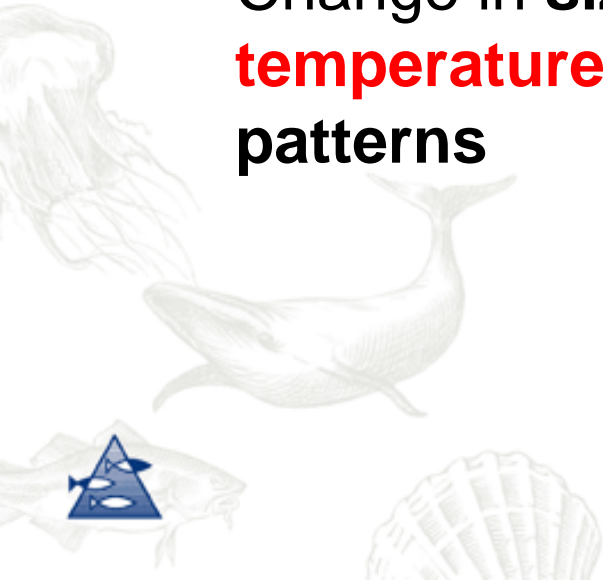
simulation exercises



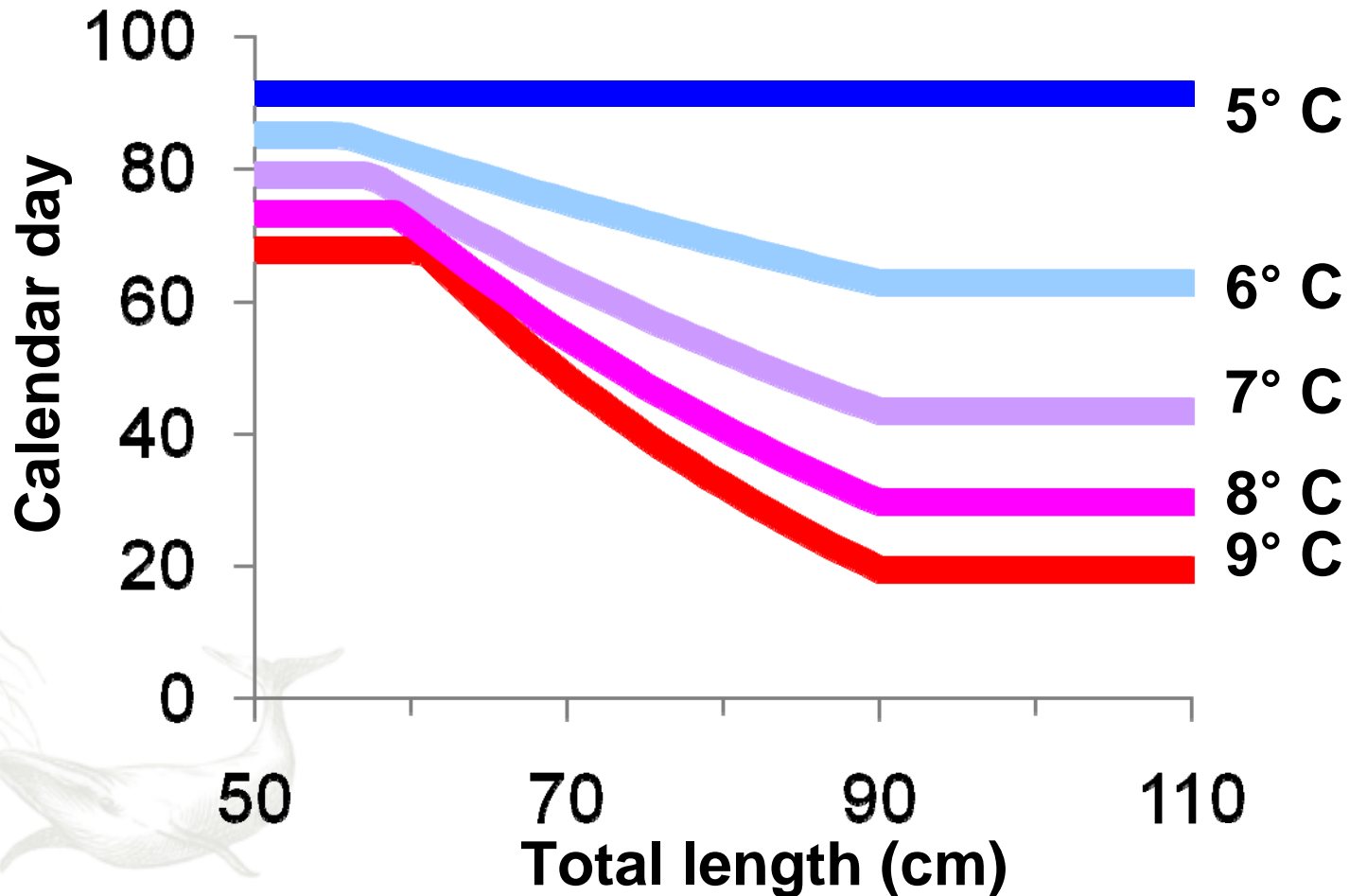
hypotheses

Barents Sea cod

- Change in **size-specific spawning time with temperature** will influence **recruitment success** (cf. Solemdal's maternal match-mismatch hypothesis. JSR 1997)
- Change in **size-specific spawning time with temperature** will lead to **size-specific fishing patterns**



size-specific spawning time vs temperature (general)



size-specific spawning time vs match-mismatch theory (BS cod)

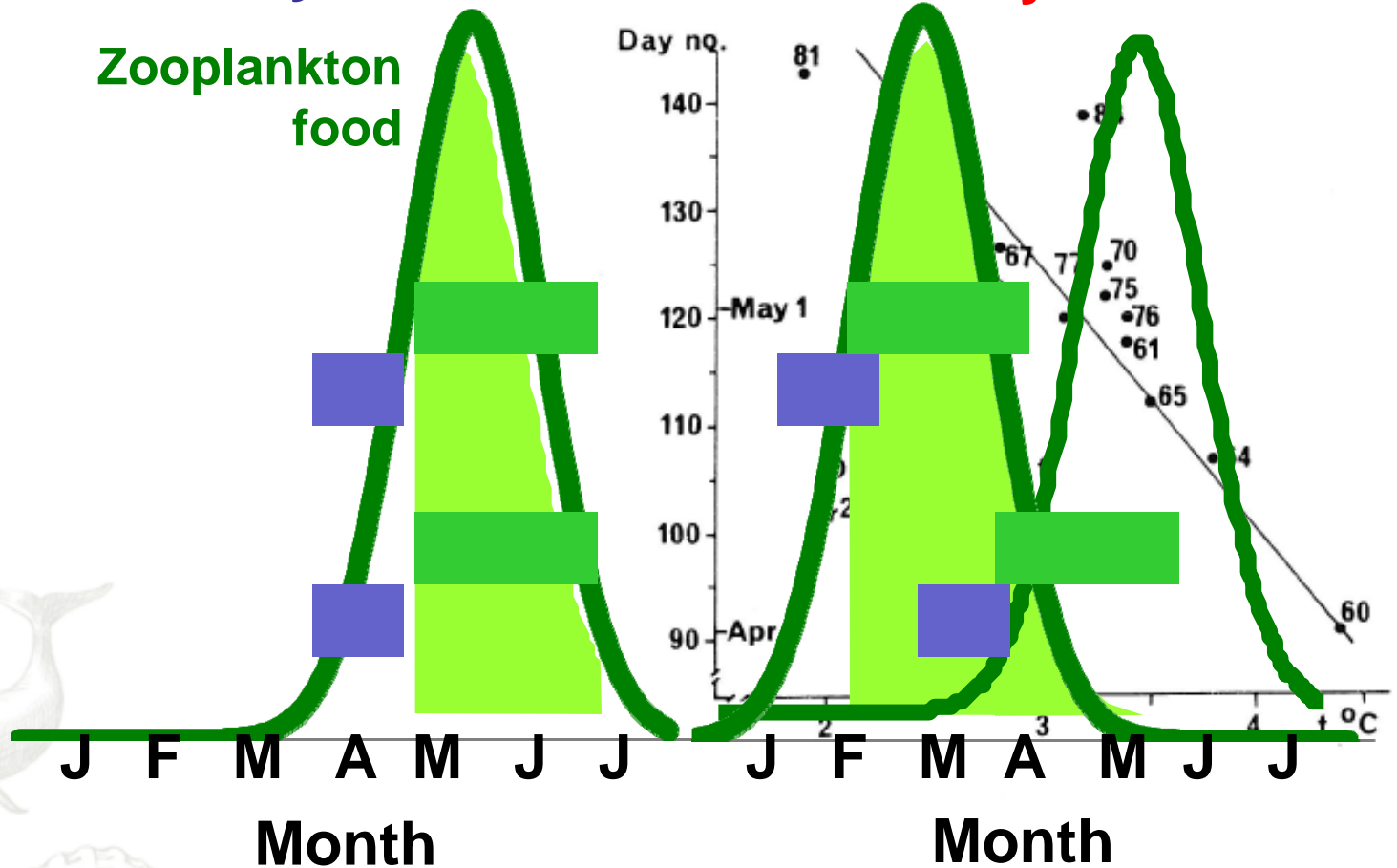
Cold year 5° C

Warm year 9° C

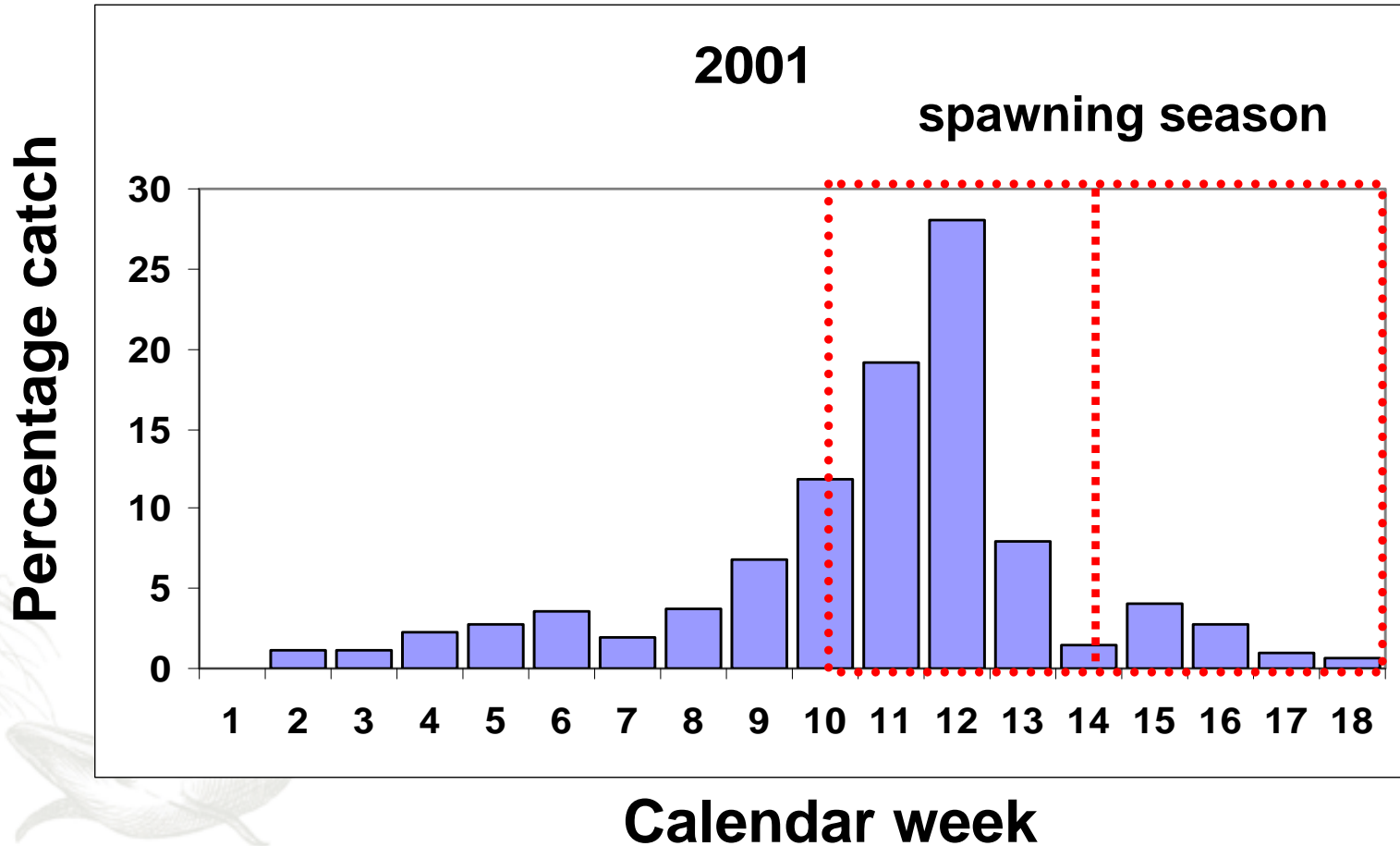
Zooplankton food

Large fish
90 cm

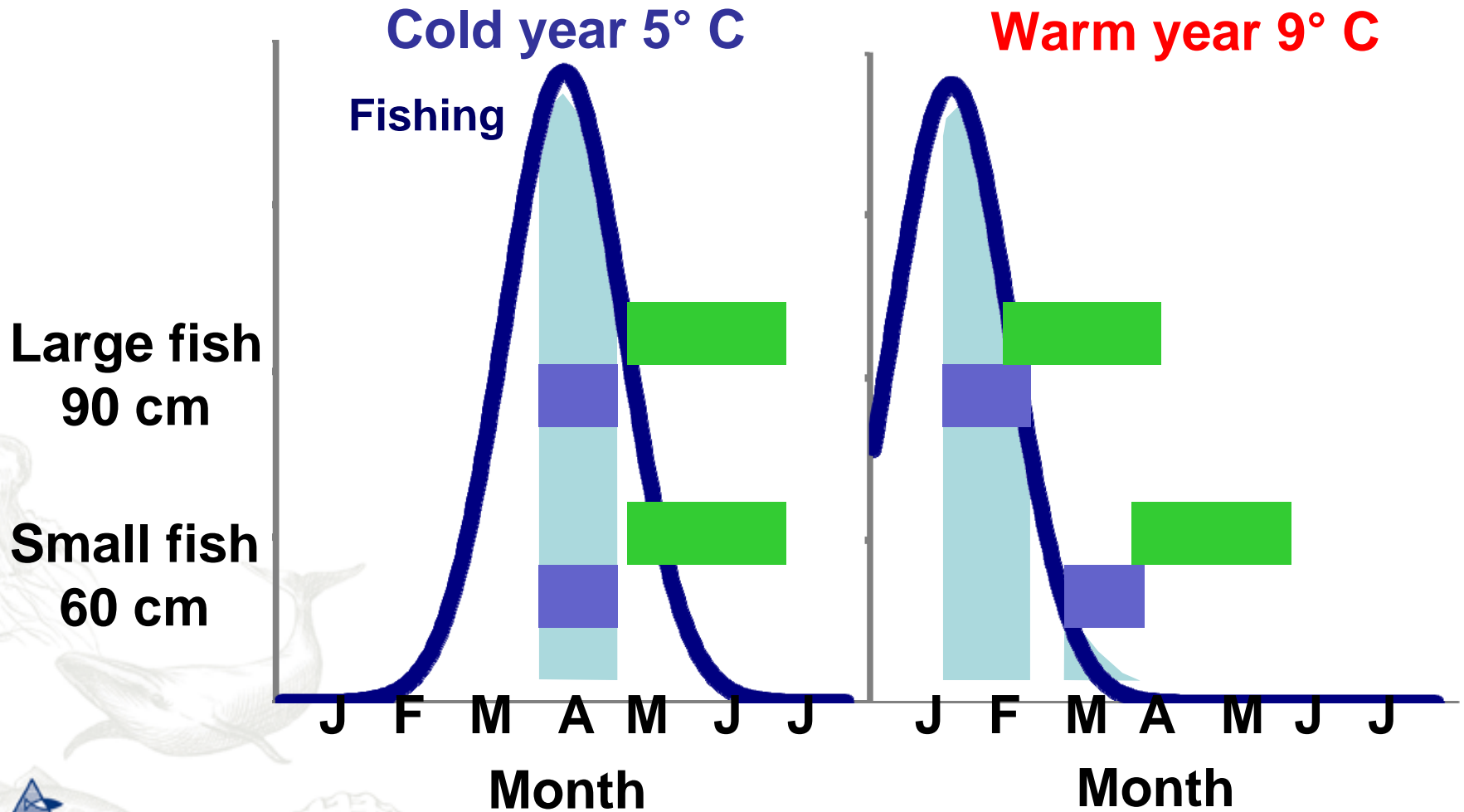
Small fish
60 cm



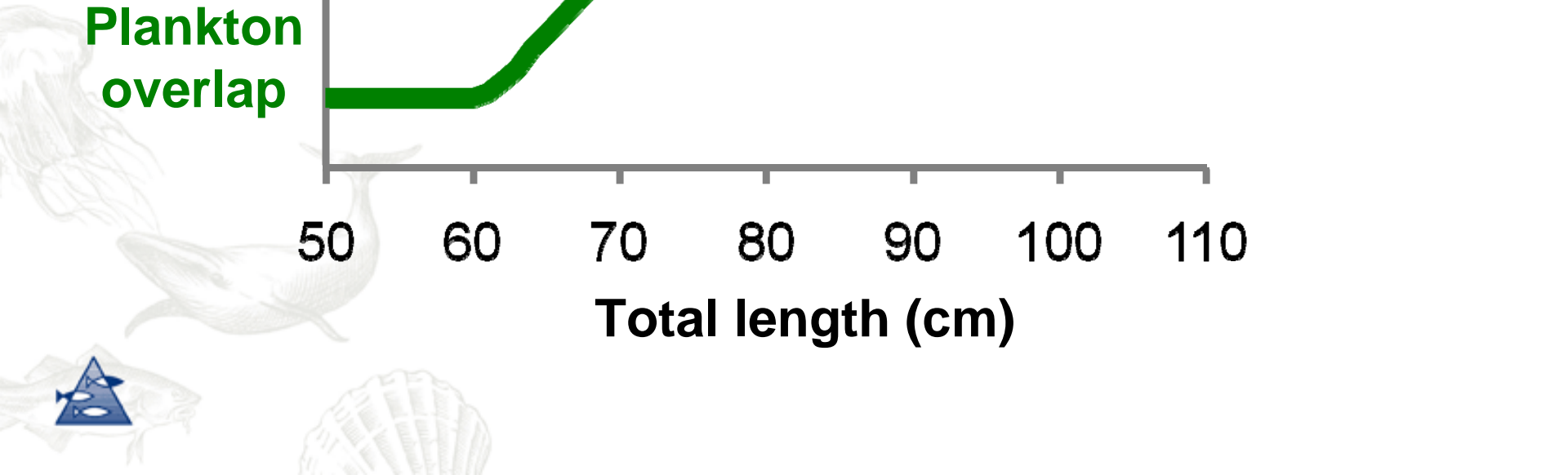
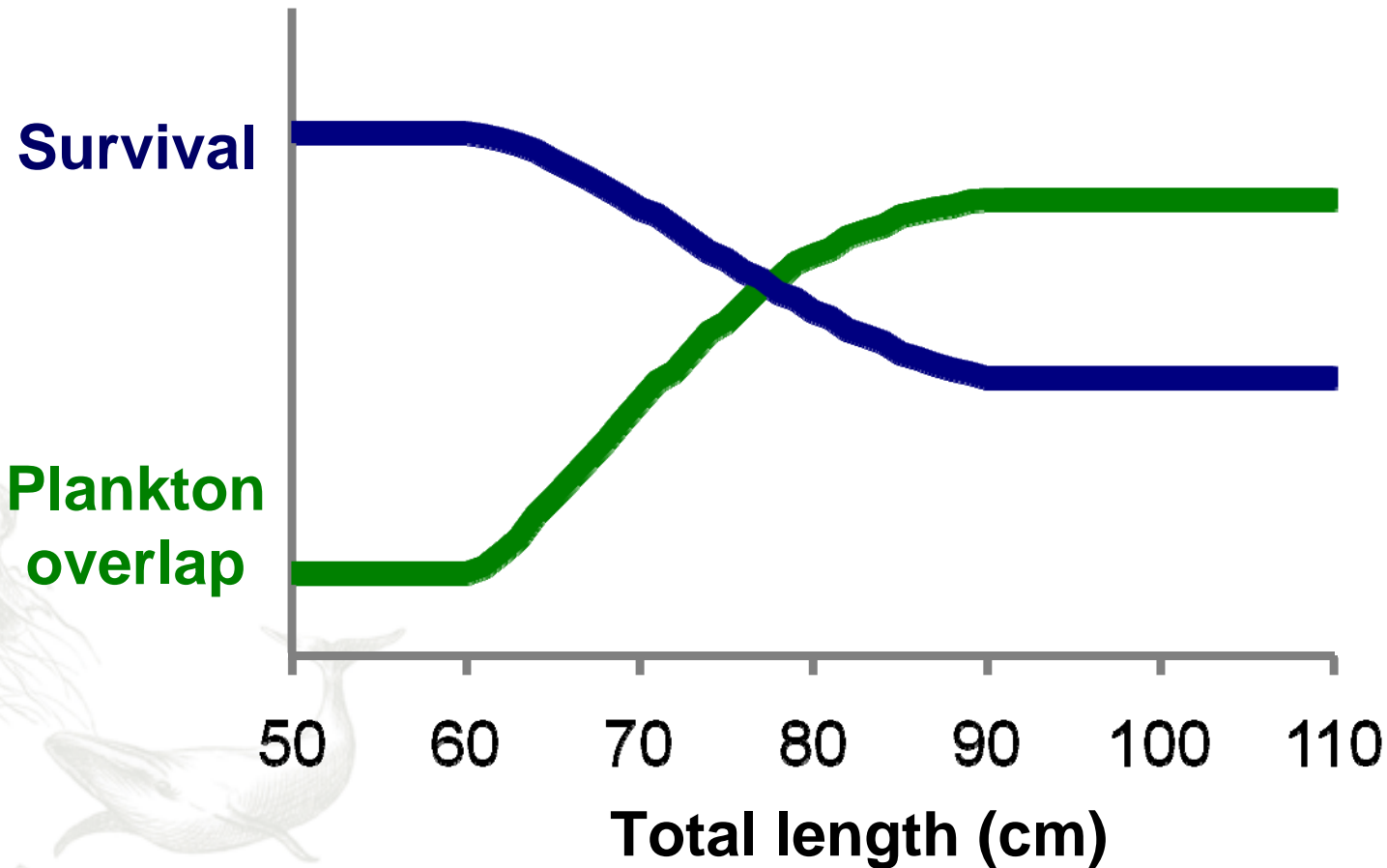
size-specific spawning time vs fishing pattern (BS cod)



size-specific spawning time vs fishing pattern (BS cod)

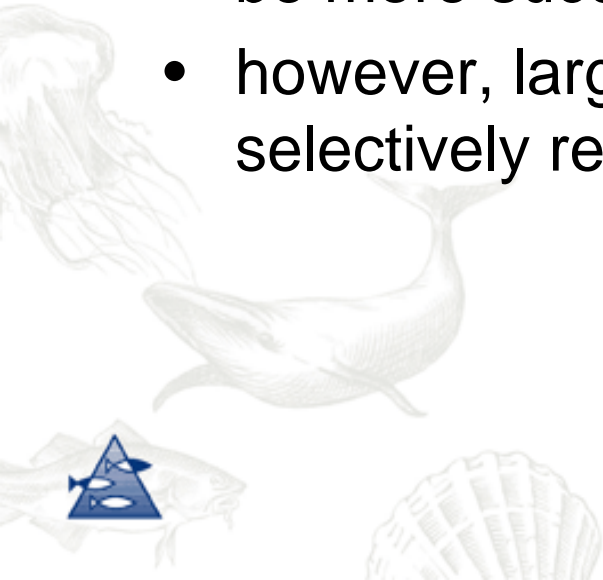


length effects in warm years (Barents Sea)



conclusions

- our simulations on size-specific spawning time are largely in line with field observations in different waters as well as experimental results
- large cod will show advanced spawning time in comparison with smaller cod in warmer water
- offspring of larger Barents Sea cod are expected to be more successful in warmer years
- however, larger Barents Sea cod will probably be selectively removed by fishing in warmer years



Thank you for your attention

