

Changes in development
timing and cohort width of
Neocalanus plumchrus
copepods in the eastern
North Pacific.

Sonia Batten and Dave Mackas



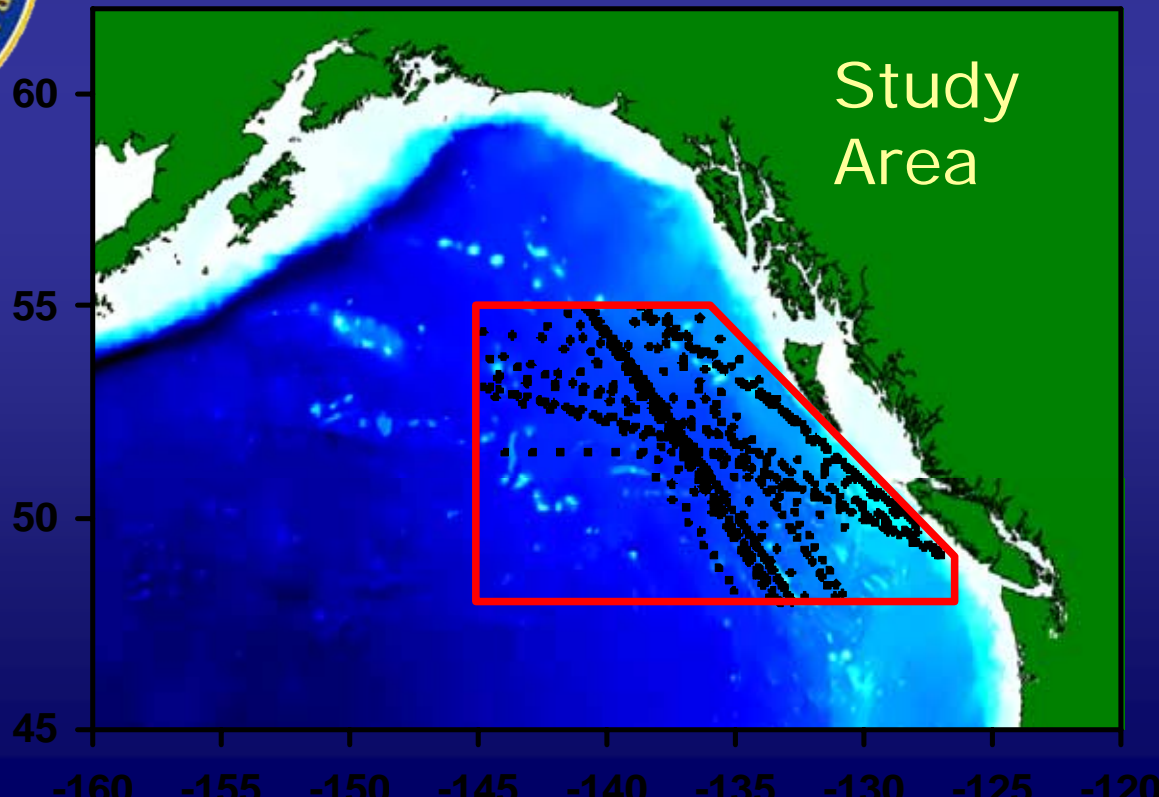
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CPR data were collected with the support of the North Pacific Research Board and the Exxon Valdez Oil Spill Trustee Council



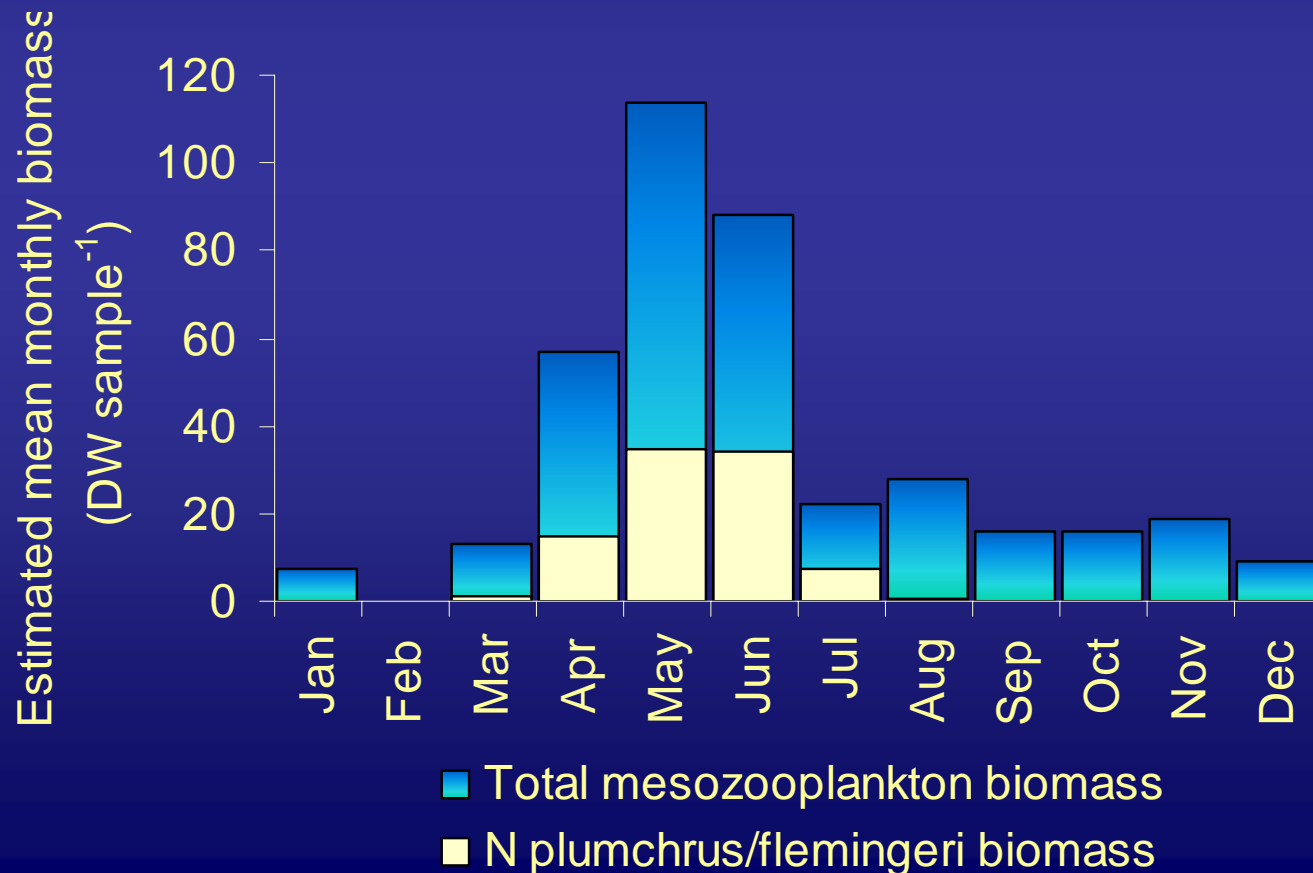
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Neocalanus plumchrus and *N. flemingeri* are large (~3.5-4.5 mm) subarctic copepods

Spend > half the year at depth, in diapause

Spend spring in the surface waters



Mackas, Goldblatt & Lewis 1998 Can. J. Fish. Aqu. Sci. 55:

Used a time-step model to examine effects of mortality on stage duration

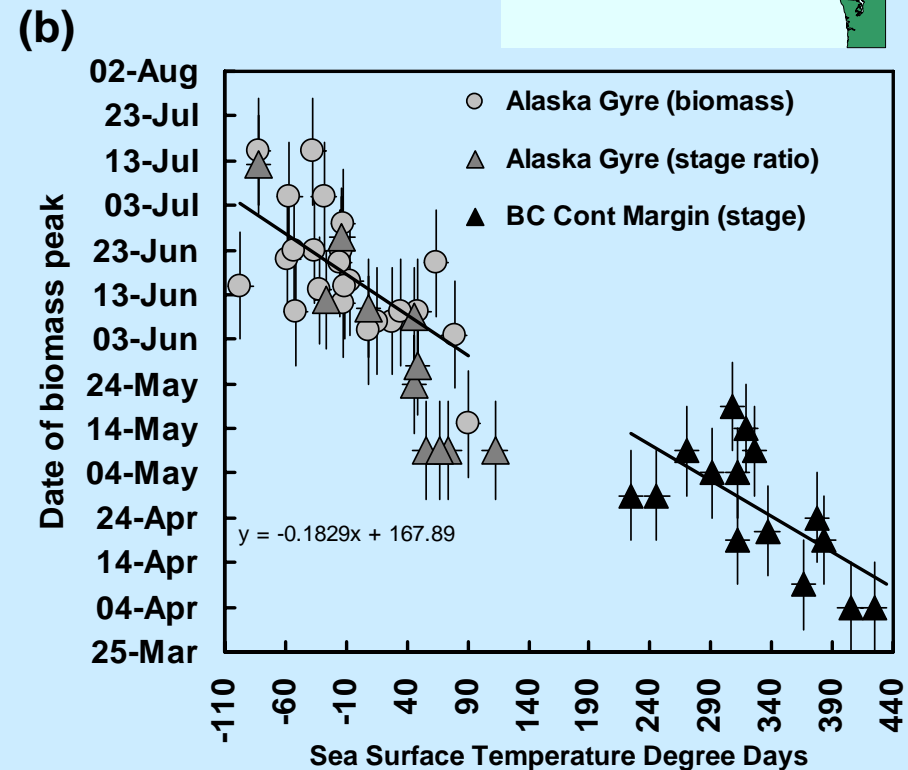
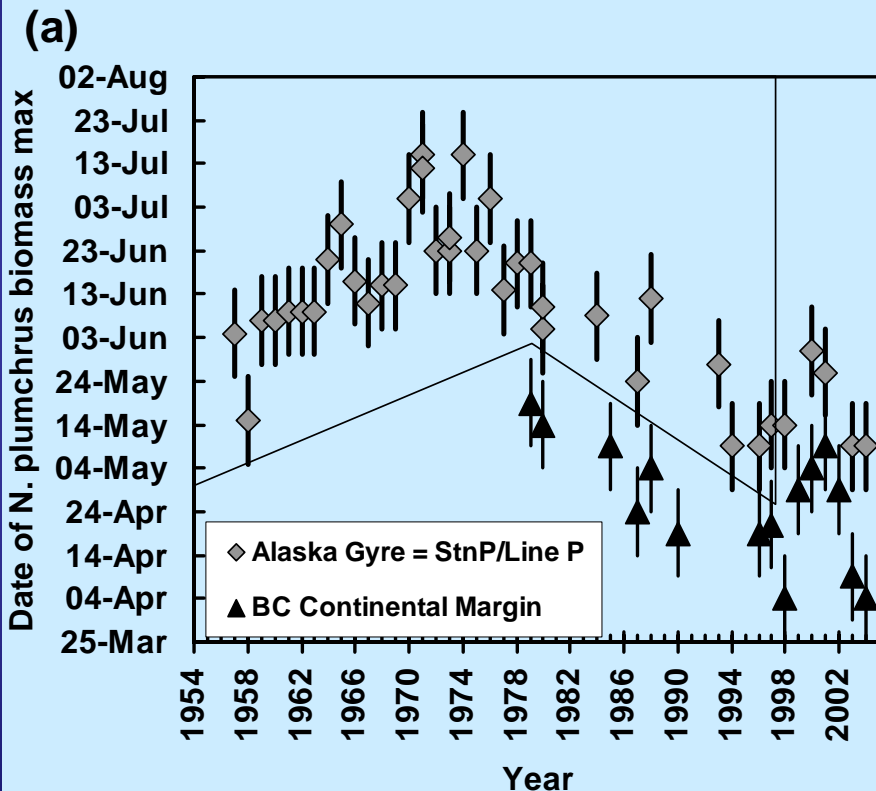
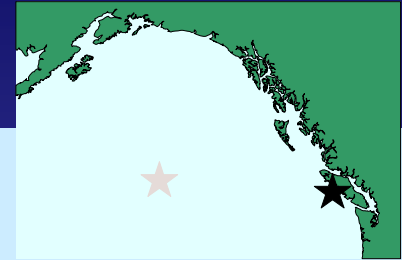
Maximum biomass of *N. plumchrus* occurred when 50% of the CII-CV population was at CV

<50% CV, total copepodites are numerous but individually small

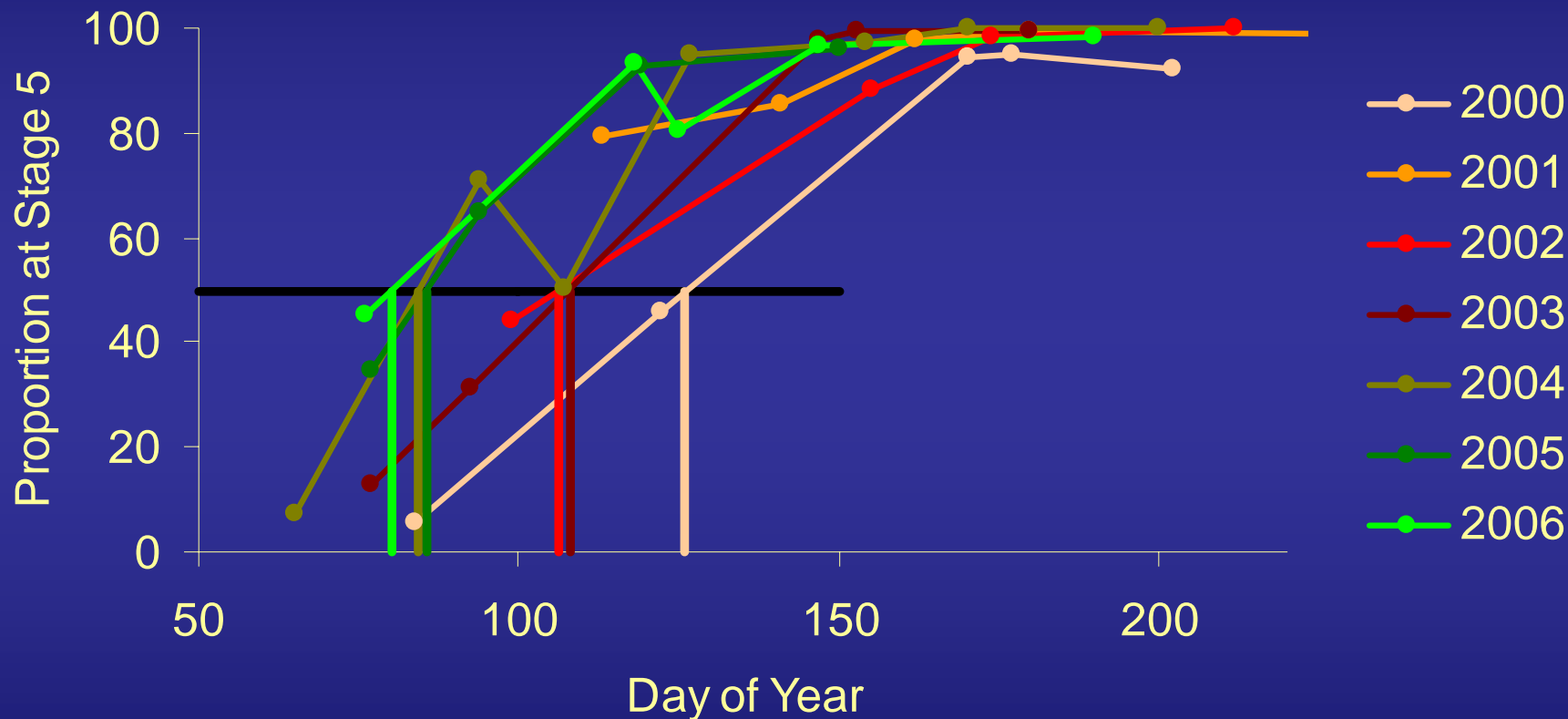
>50% CV, large copepodites but abundance reduced by mortality and down migration

This index allowed a precise date (± 5 days) to be calculated from relatively infrequent sampling.

Index was used to examine interdecadal changes in timing of peak biomass:

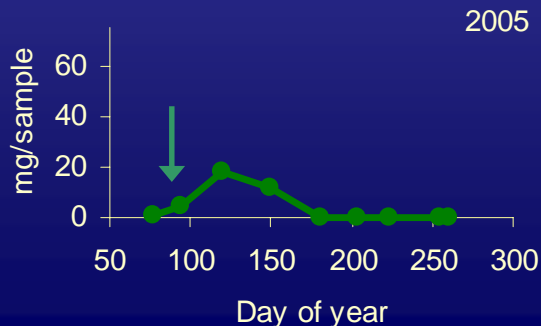
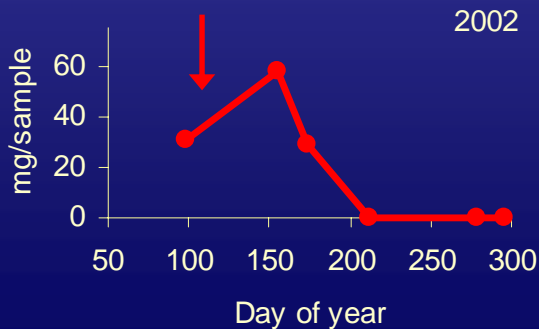
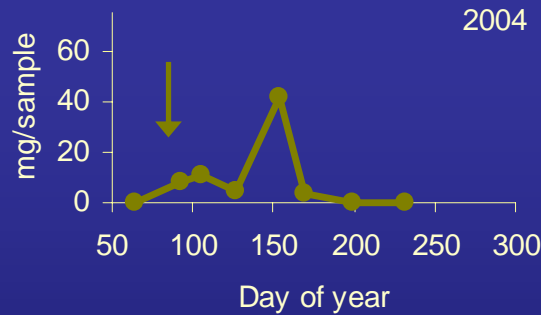
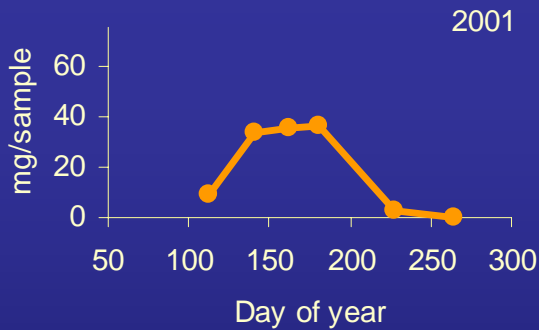
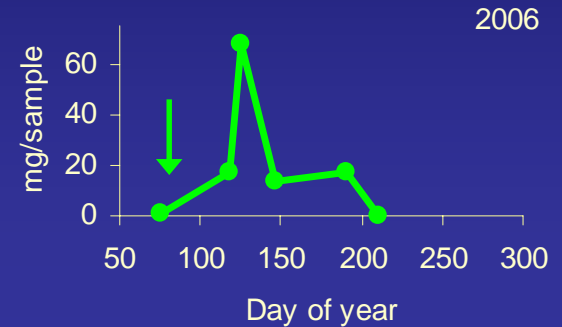
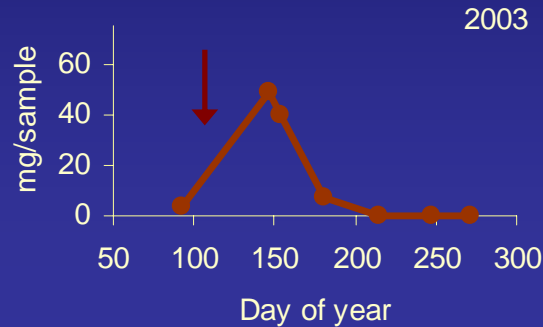
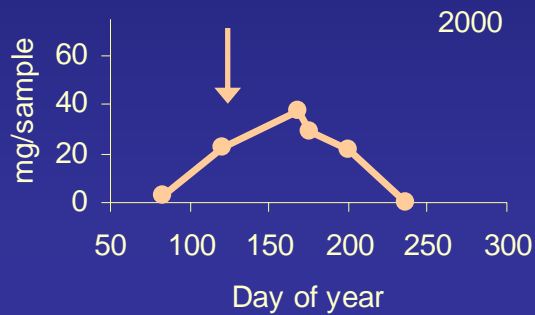


The more recent, more frequent CPR data showed a similar result

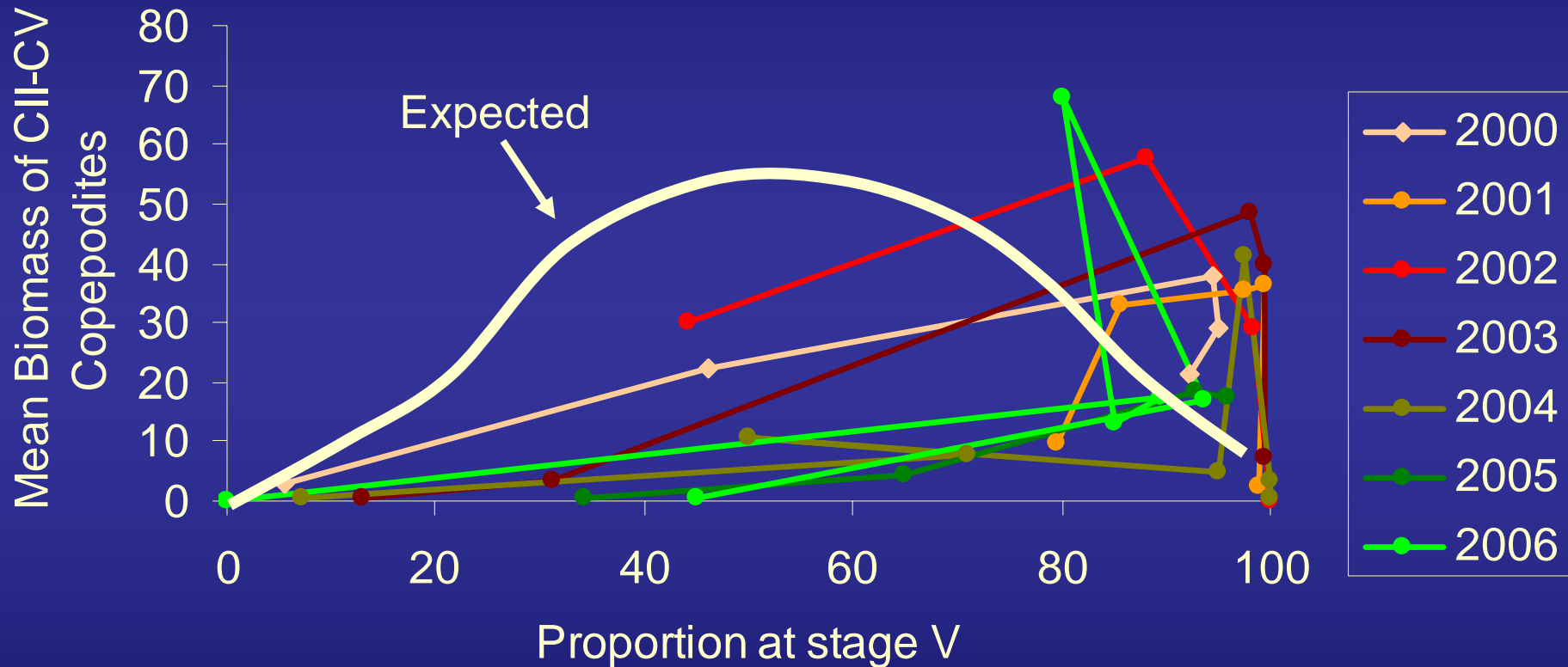


However, the date predicted by stage composition (day 85-125) was always earlier than the date suggested by the estimated biomass (from abundance data):

Biomass



And plotting % stage V against biomass showed that the peak occurred very close to 100% stage V:



(2004, 05 and 06 are complicated by a smaller second generation/cohort)

Why is this? A sampling effect?



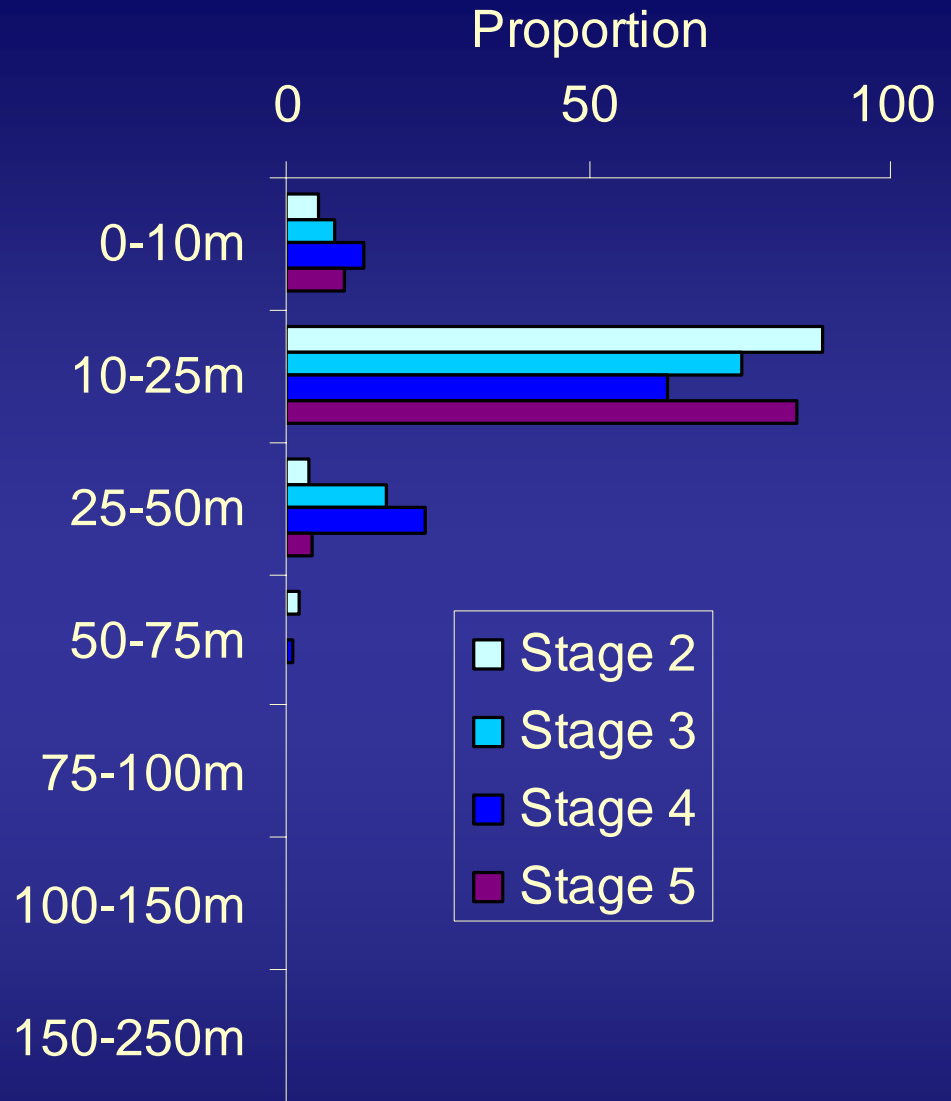
CPR ~surface 10m



Bongo - integrated surface 150m

Used depth resolved BIONESS data for same area (1986, 87, 93, 2000-2004) to examine whether stages had a different depth preference:

Although the CPR will catch only a fraction it should catch each stage in the correct proportion.



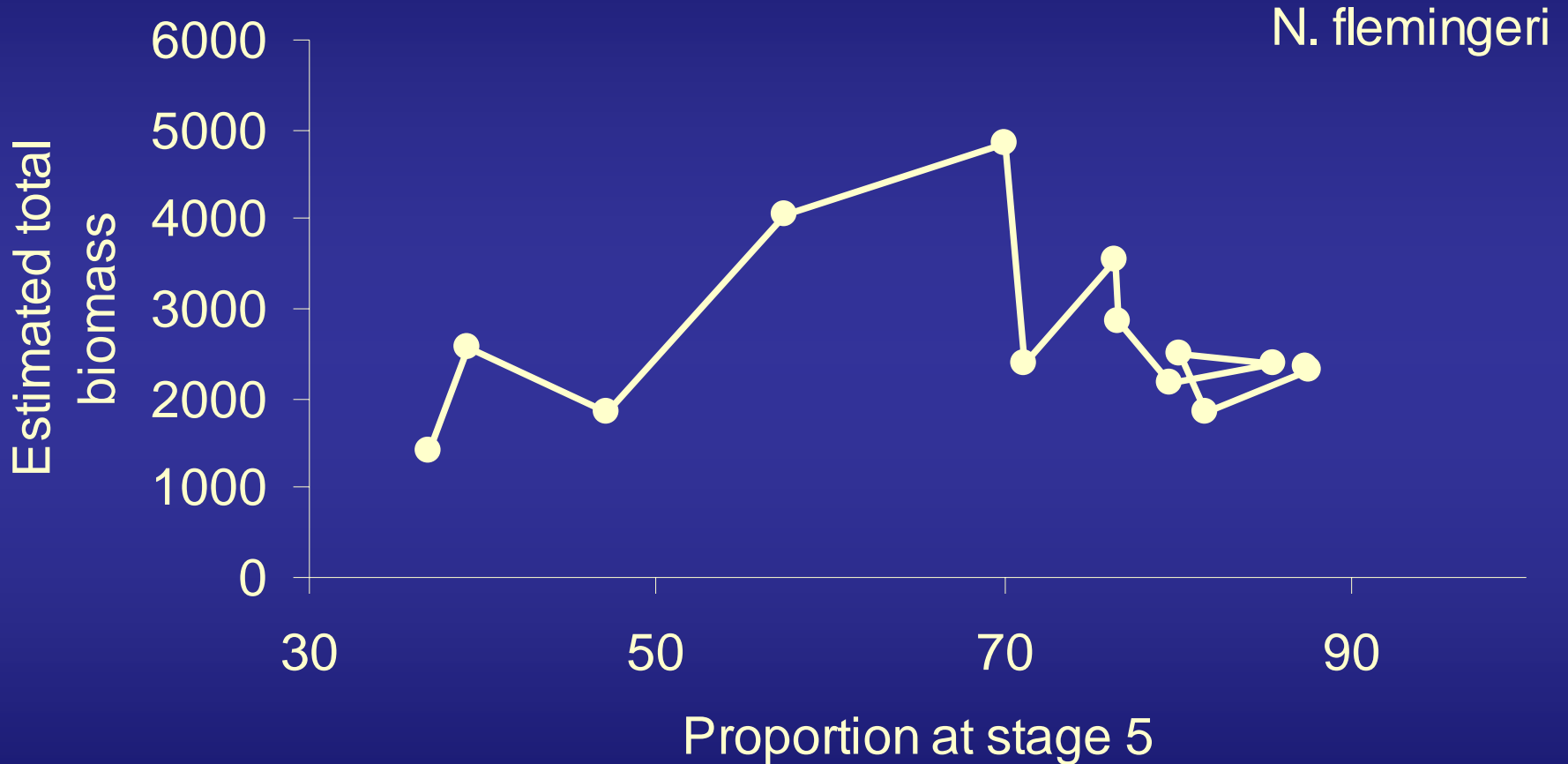
If not a sampling effect it must be biological.

Are there other data that independently show that peak biomass occurs at 50% stage V?

Miller sampled at Station P in May 1988 for 22 days.

Too early for *N. plumchrus* CV to occur in high numbers but *N. flemingeri* CV increased from 37% to 93%

Estimated total biomass from stage counts and dry weight data



This shows the predicted pattern

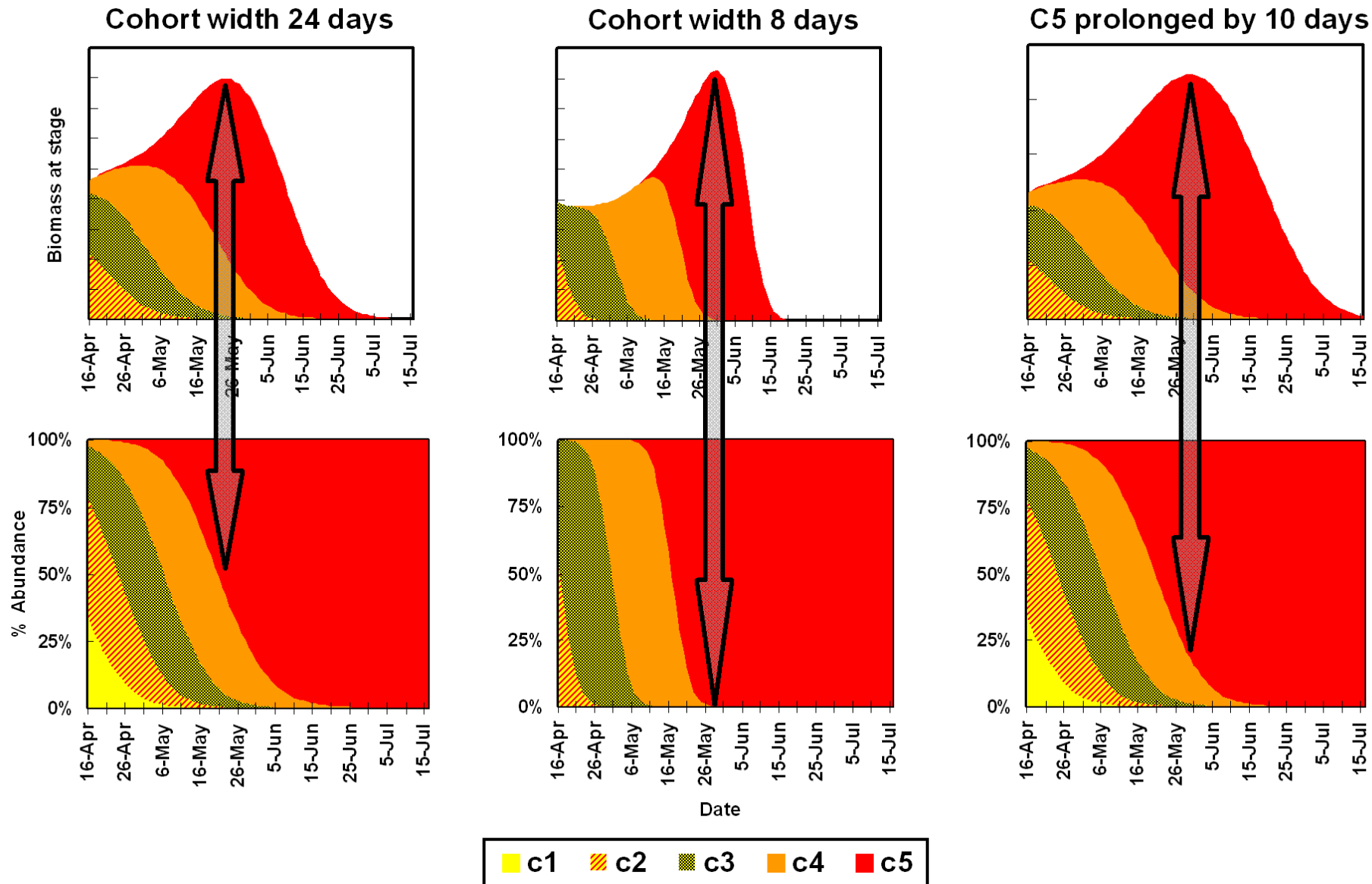
Limited evidence but these data do show that peak biomass has occurred at ~50% CV in the past.

Two scenarios could result in the post 1999 pattern seen in the CPR time series:

1. Longer stage duration for CV
2. The cohort is more synchronised (if completely synchronised then peak biomass would occur exactly when 100% CV)

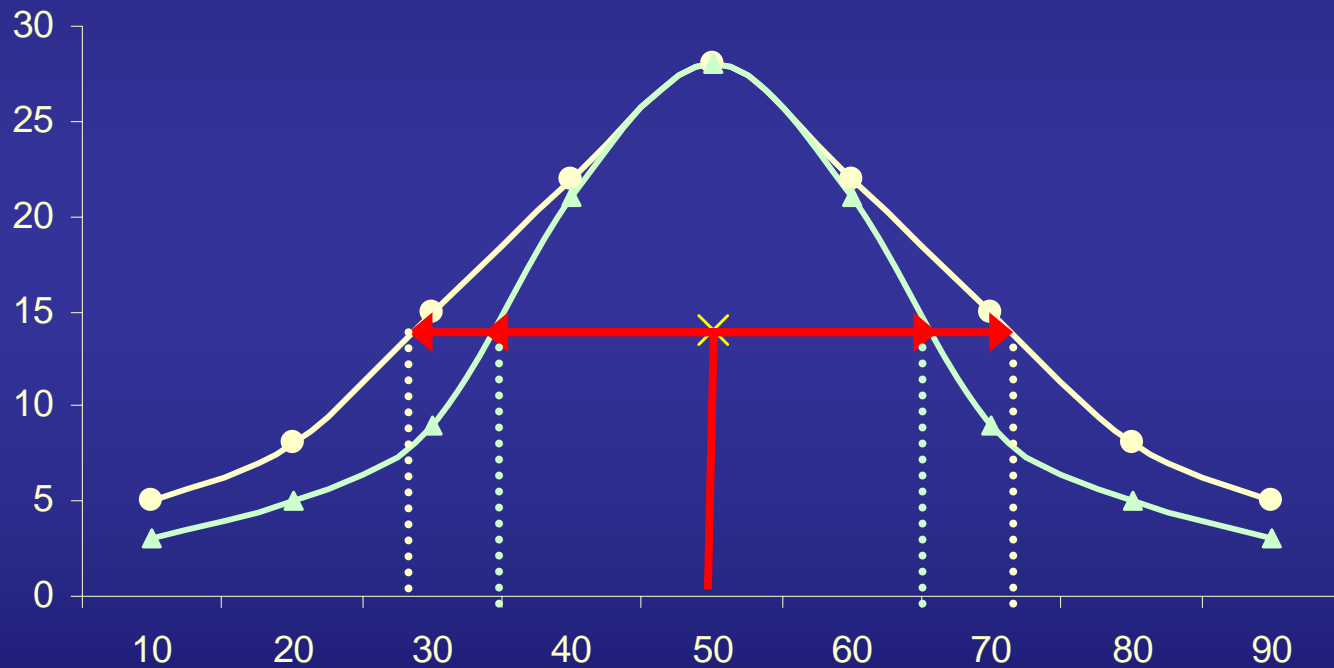
Both Miller et al (84) and Mackas et al (98) suggest that spawning occurs for a lengthy period but conditions are right for maturation for only a relatively short period of time.

Mackas model from 98 (left) re-drawn to show reduced cohort width and CV extension

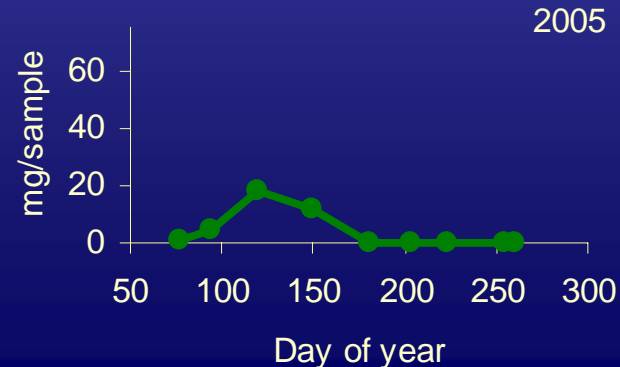
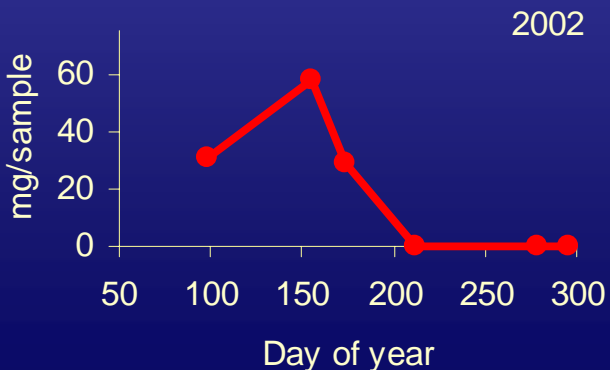
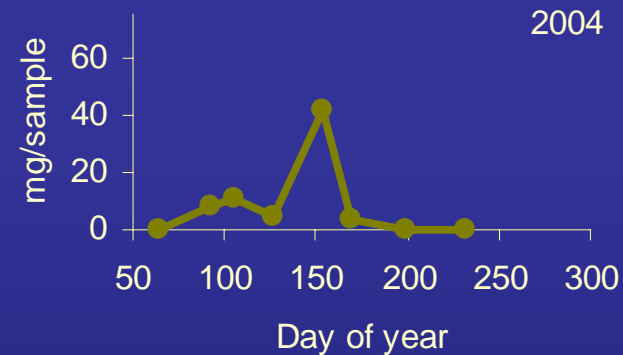
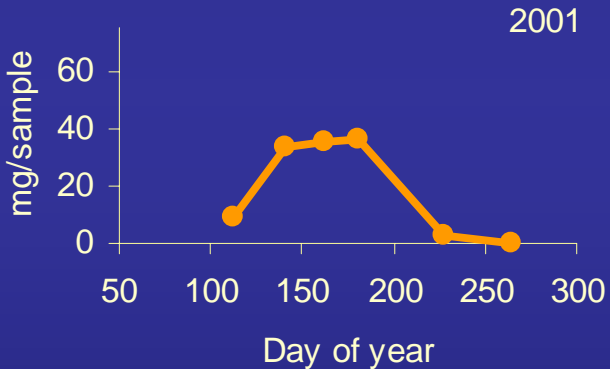
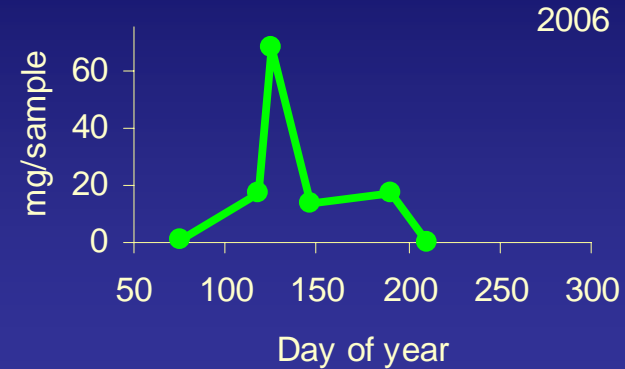
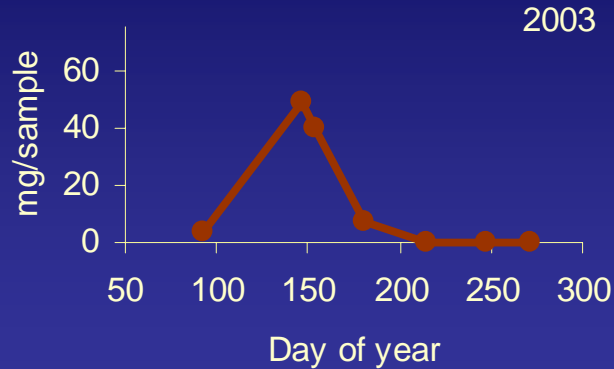
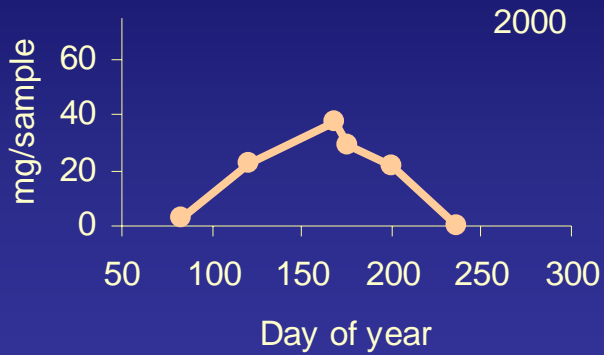


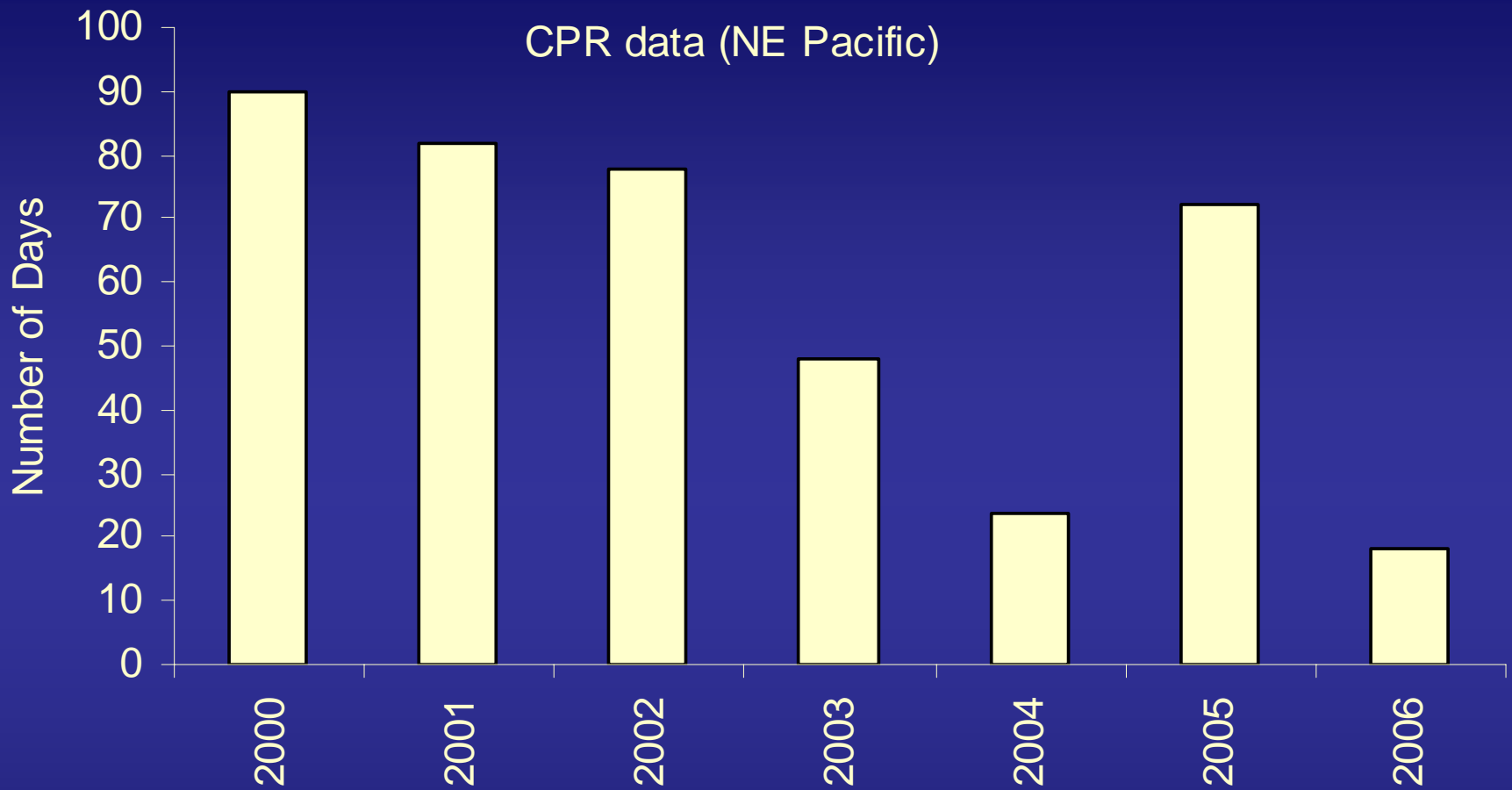
Can we measure cohort width?

A crude index is the **width at half max amplitude**:



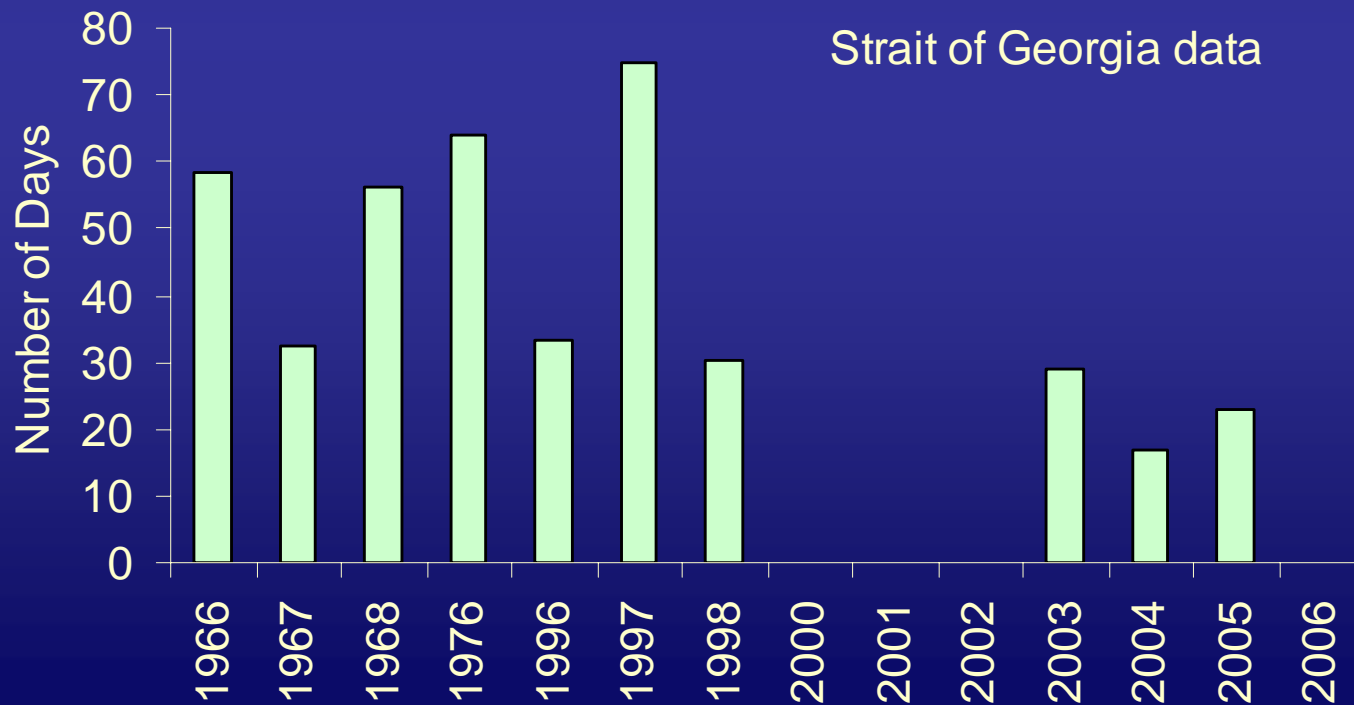
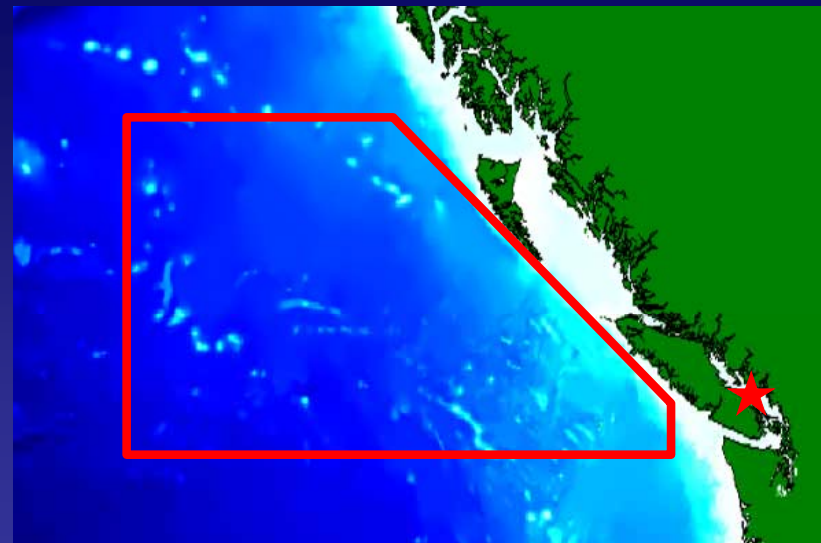
Back to the total biomass plots:





But, are there any other time series of data that extend back before 2000?

Data from the Strait of Georgia exist (★, courtesy of Rana El-Sabaawi) although pre-2000 data are collected differently to post 2000 data



There is a lot of speculation and not enough data yet to back it up but,

1. The main contributor to the spring mesozooplankton biomass, *Neocalanus plumchrus*, has an earlier peak in biomass in recent years.
2. The peak occurs when more of the population are at the sub-adult level suggesting that the cohort is narrower.
3. This implies that conditions suitable for maturation of copepodites occur for a shorter time than previously
4. This has implications for predators that time their migration or reproduction to take advantage of this food source – it has lately been early and brief!

Thank you

