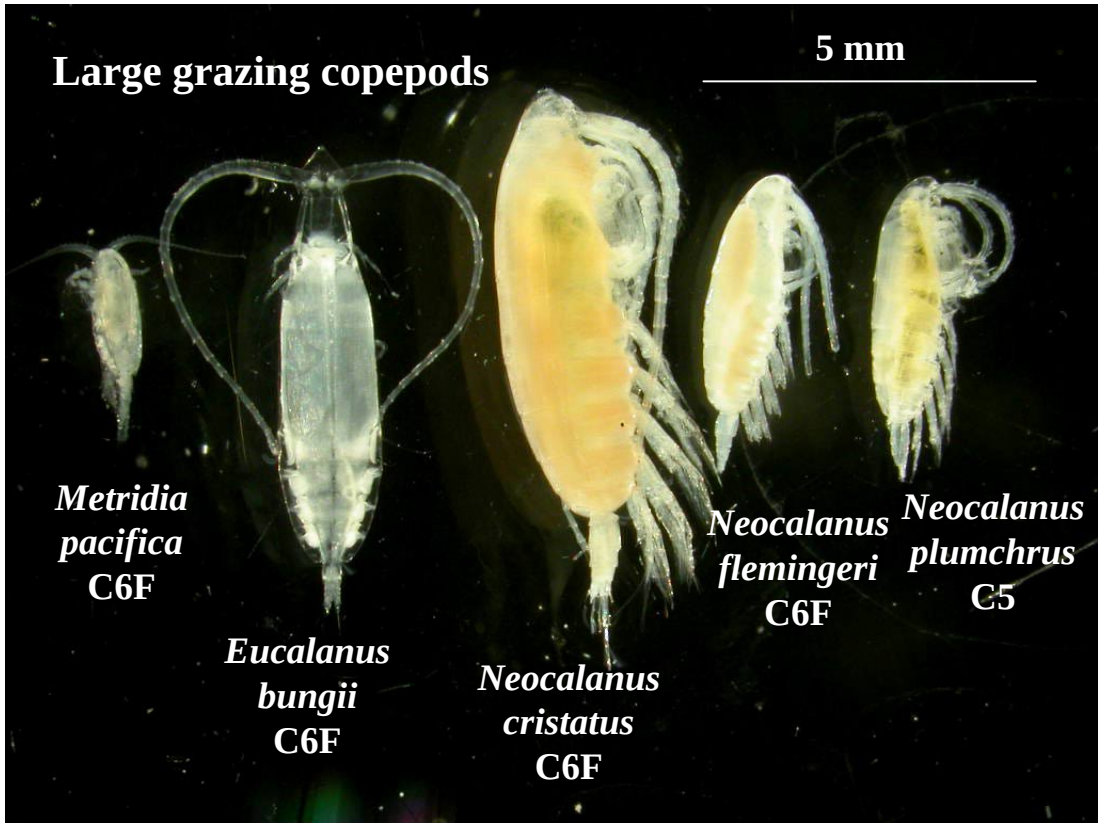
Year-to-year variations in developmental timing of large grazing copepods at Site H in the Oyashio region



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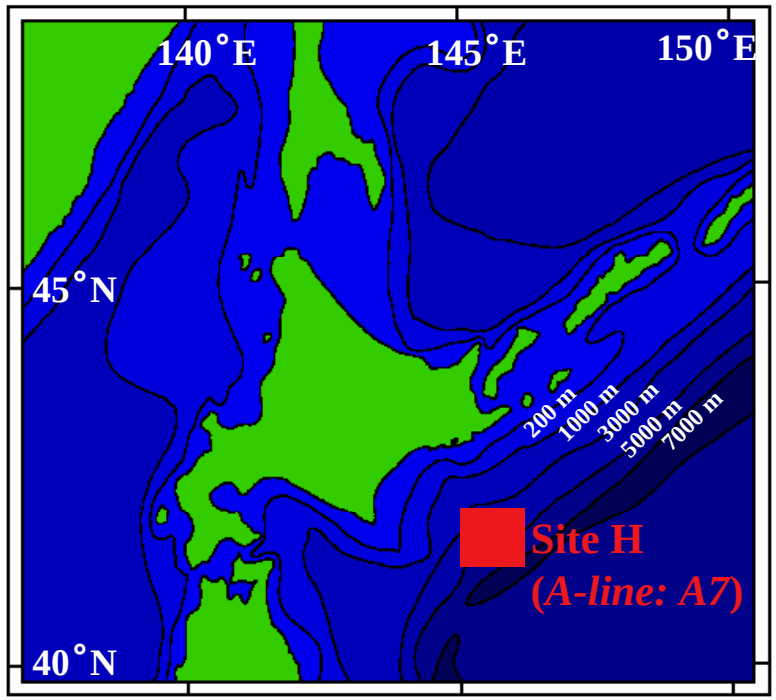
Time series sampling



Phase I
Sep. 1996 - Oct. 1997
60-cm ring closing net
0.1 mm mesh
0-500 m vertical haul

Phase II
May 2002 - Mar. 2004
Twin-NORPAC net (45-cm ring)
0.1 mm mesh, 0.35 mm
0-150 m, 0-500 m vertical haul

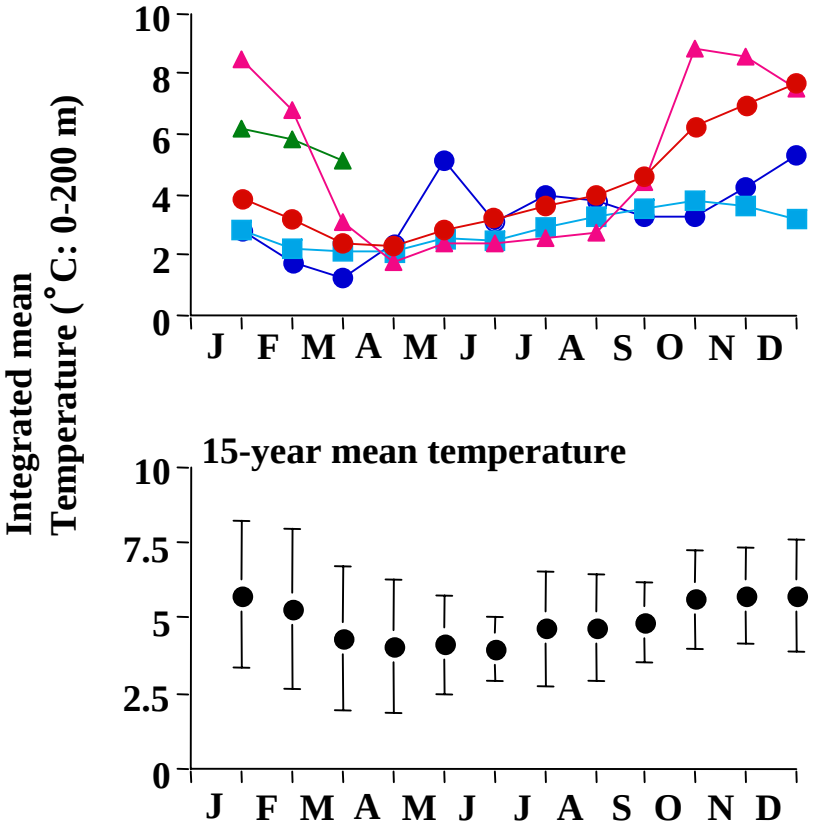
Copepods and its copepodid stages identified (samples from 0.1 mm mesh):

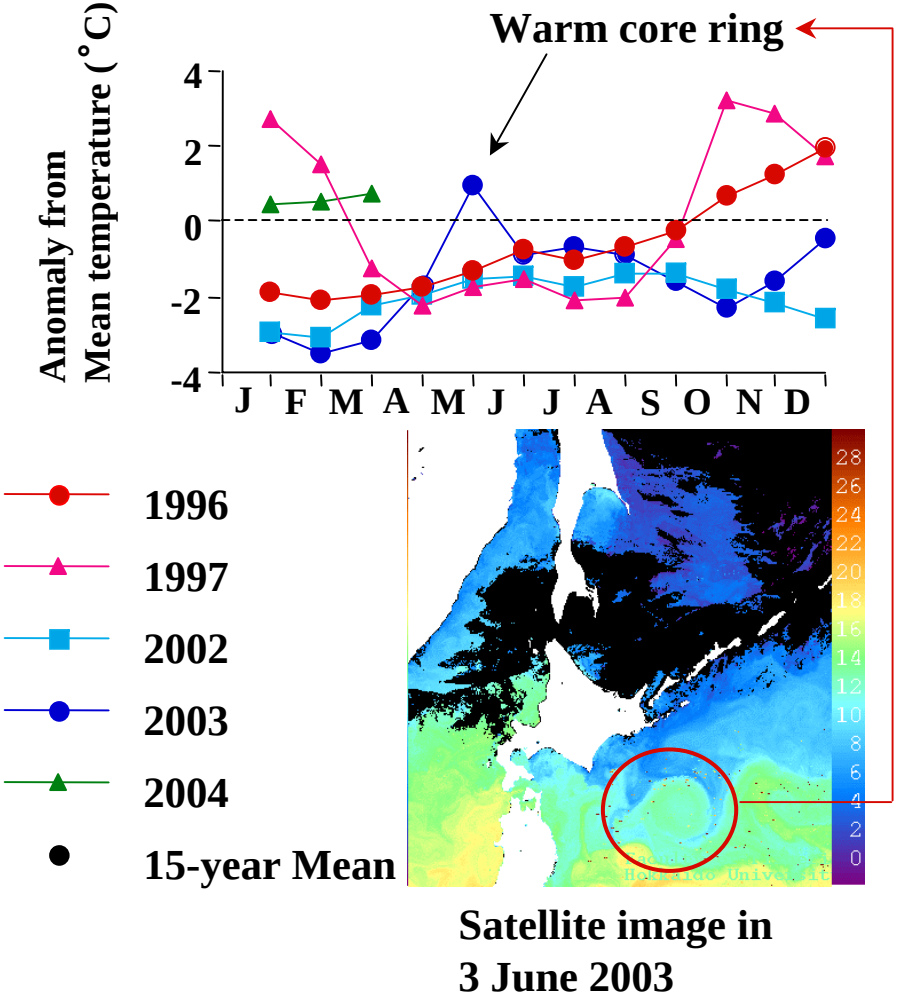
- ***Metridia pacifica*** **(C1-C6)**
- ***Eucalanus bungii*** **(N, C1-C6)**
- ***Neocalanus cristatus*** **(C1-C6)**
- ***Neocalanus flemingeri*** **(C1-C6)**
- ***Neocalanus plumchrus*** **(C1-C6)**

Mean stage: $S = \Sigma (n\,An)/\Sigma\,An$, where *An* is abundance of *n*-th stage

Copepod wet mass= integrating individual wet mass over copepodid stages

Water temperature

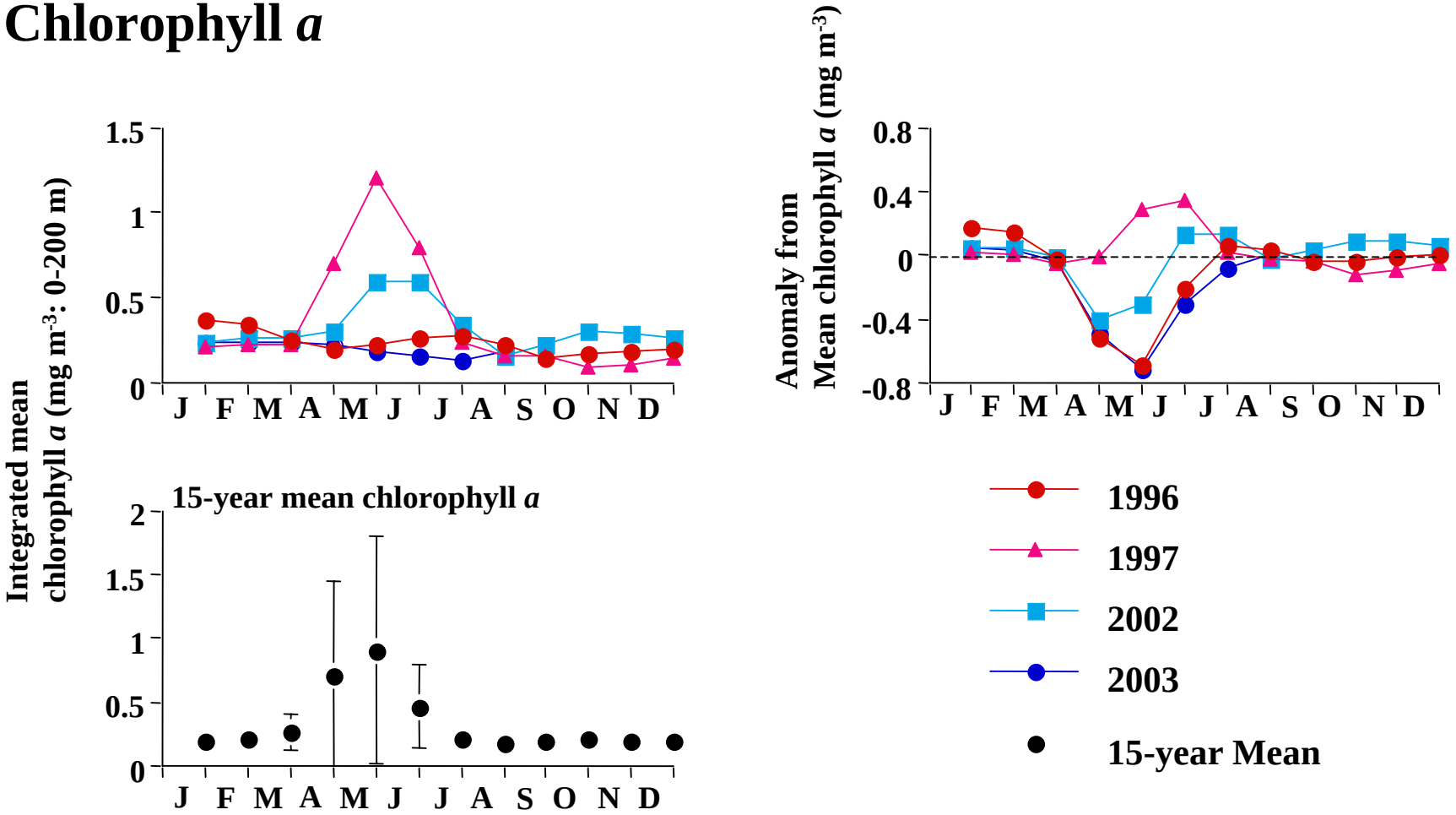




Satellite image in 3 June 2003

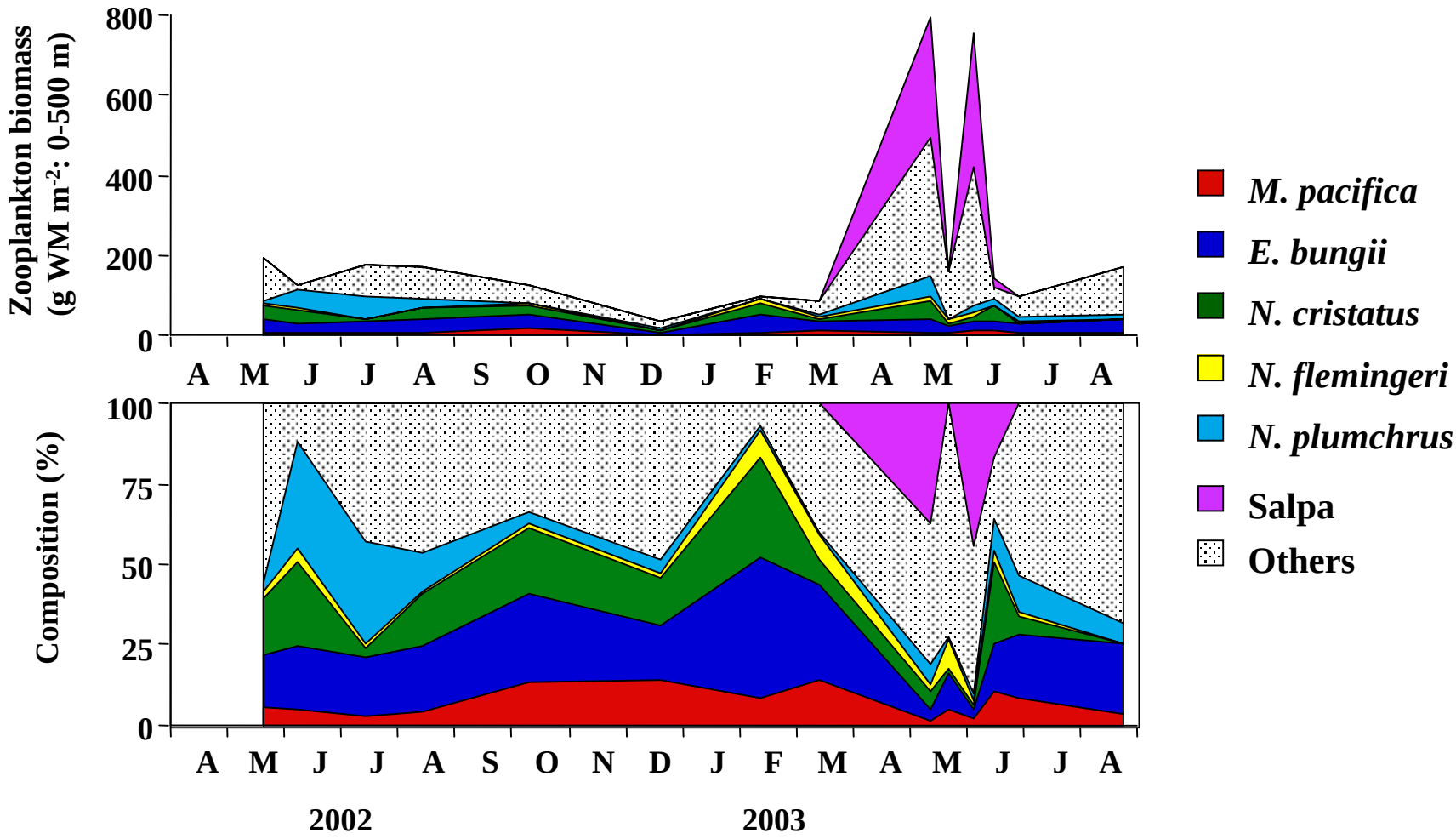
Inter-annual changes were greater in winter.
Very high temperature seen in May 2003 is due to the effect of warm core ring.

Chlorophyll *a*



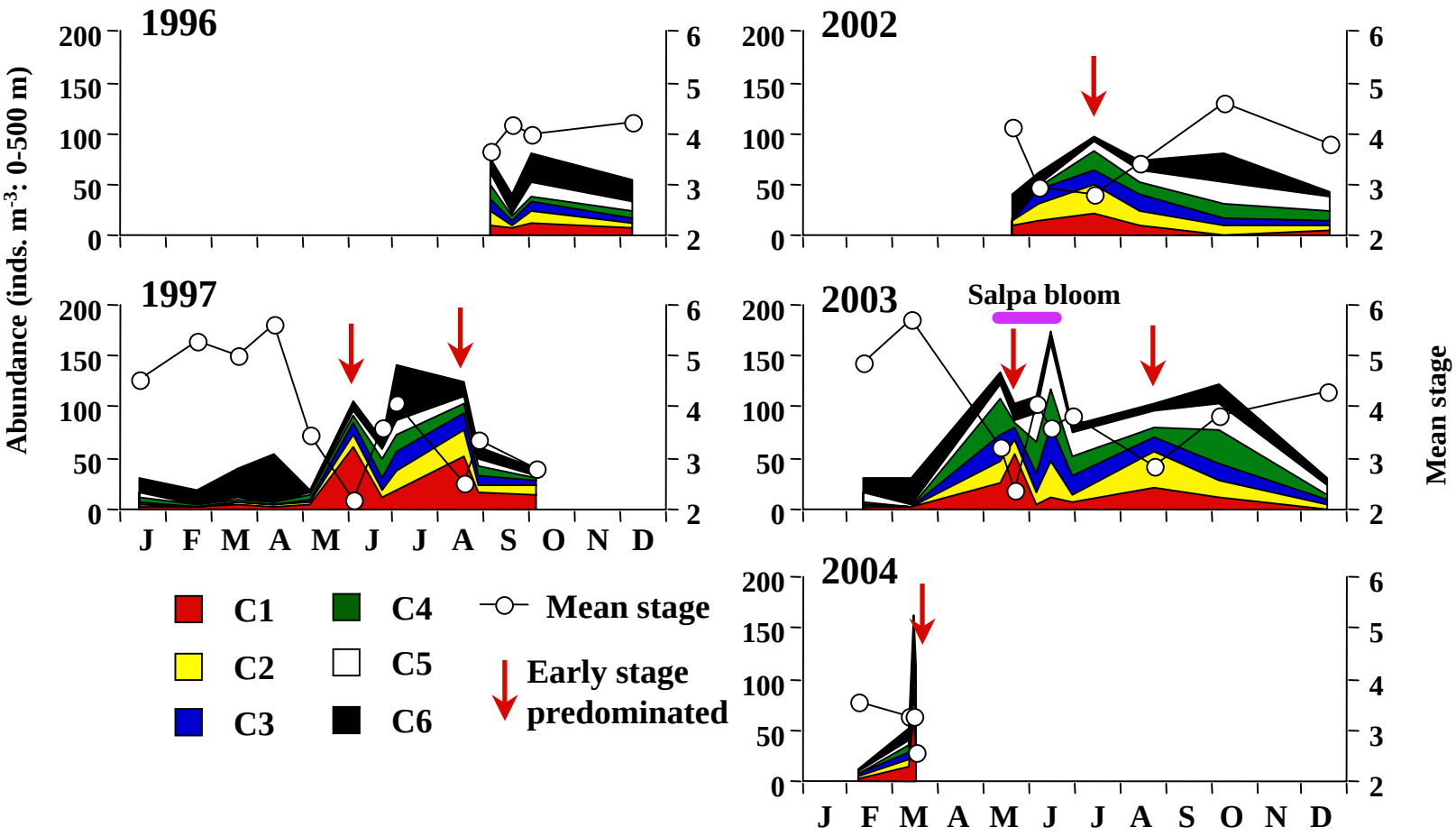
With regard to season, inter-annual changes in chlorophyll *a* were most marked in spring. The magnitude of spring bloom was greatest in 1997.

Zooplankton biomass (species composition)



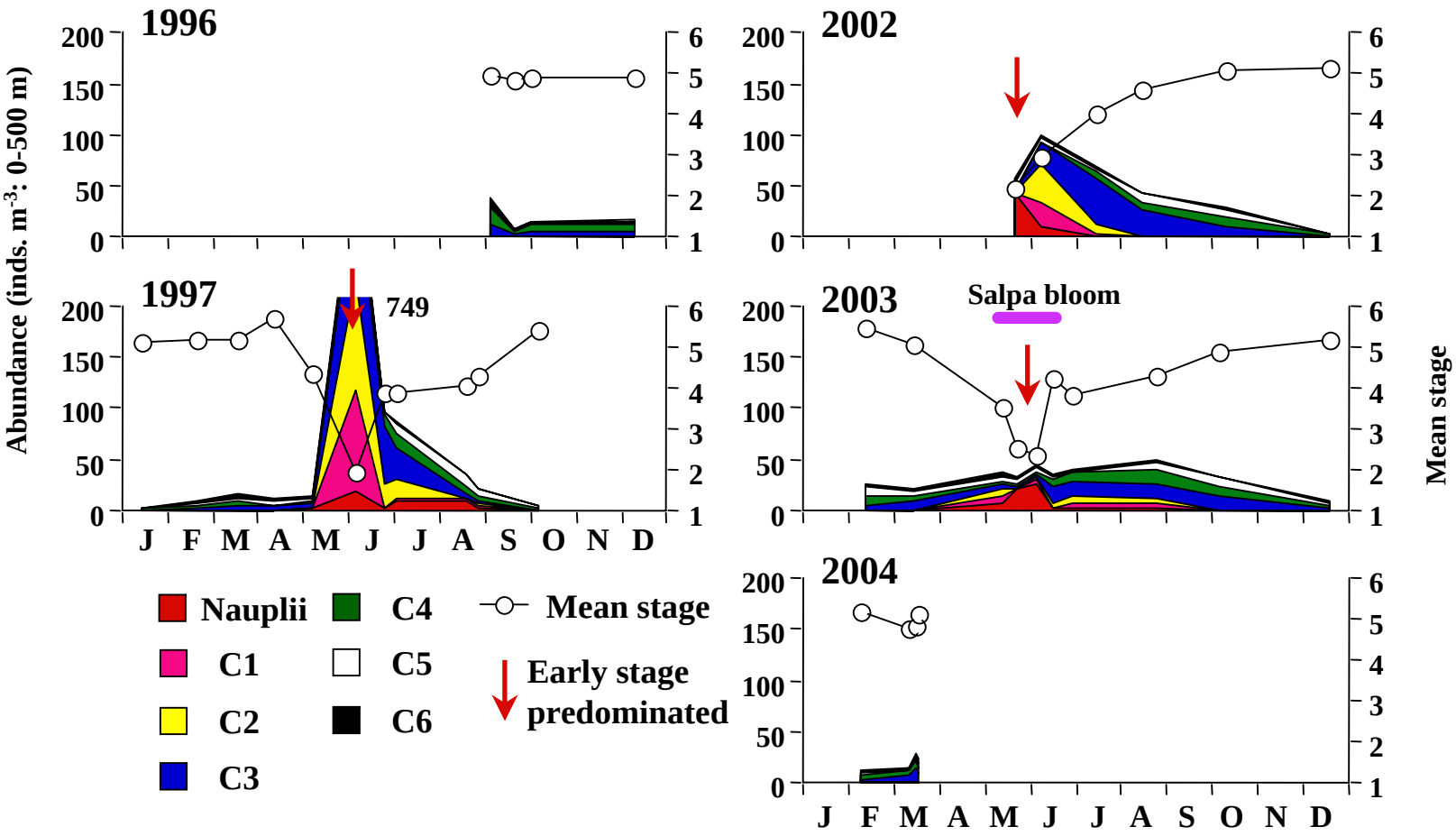
Large grazing copepods composed of 52±22% (mean±1 sd) of total zooplankton mass. Salpida bloom was recorded in May-June 2003.

Abundance and population structure: *Metridia pacifica*



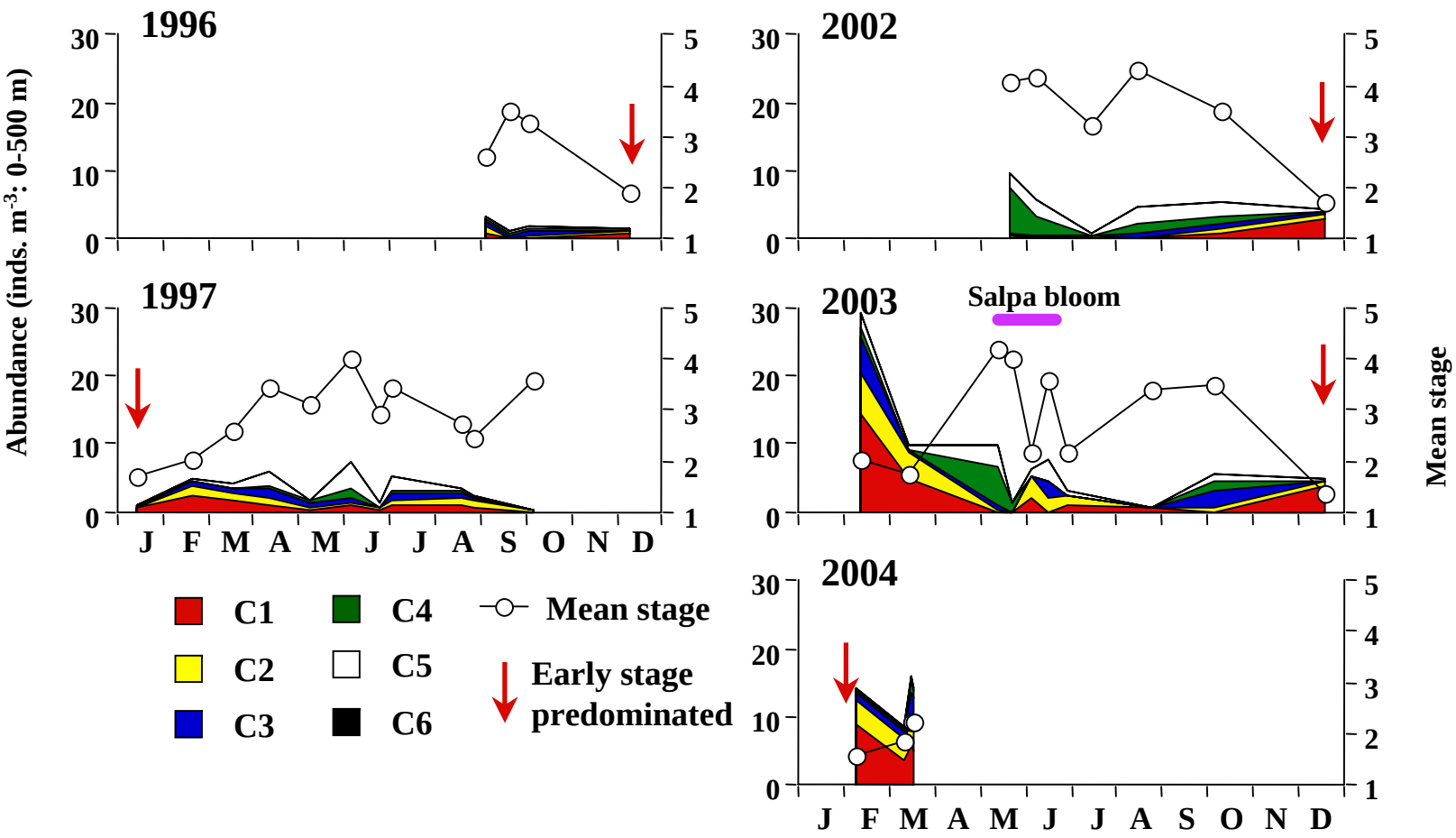
Typically two peaks of recruitment of early copepodids in a year.
The recruitment season variable with year.

Eucalanus bungii



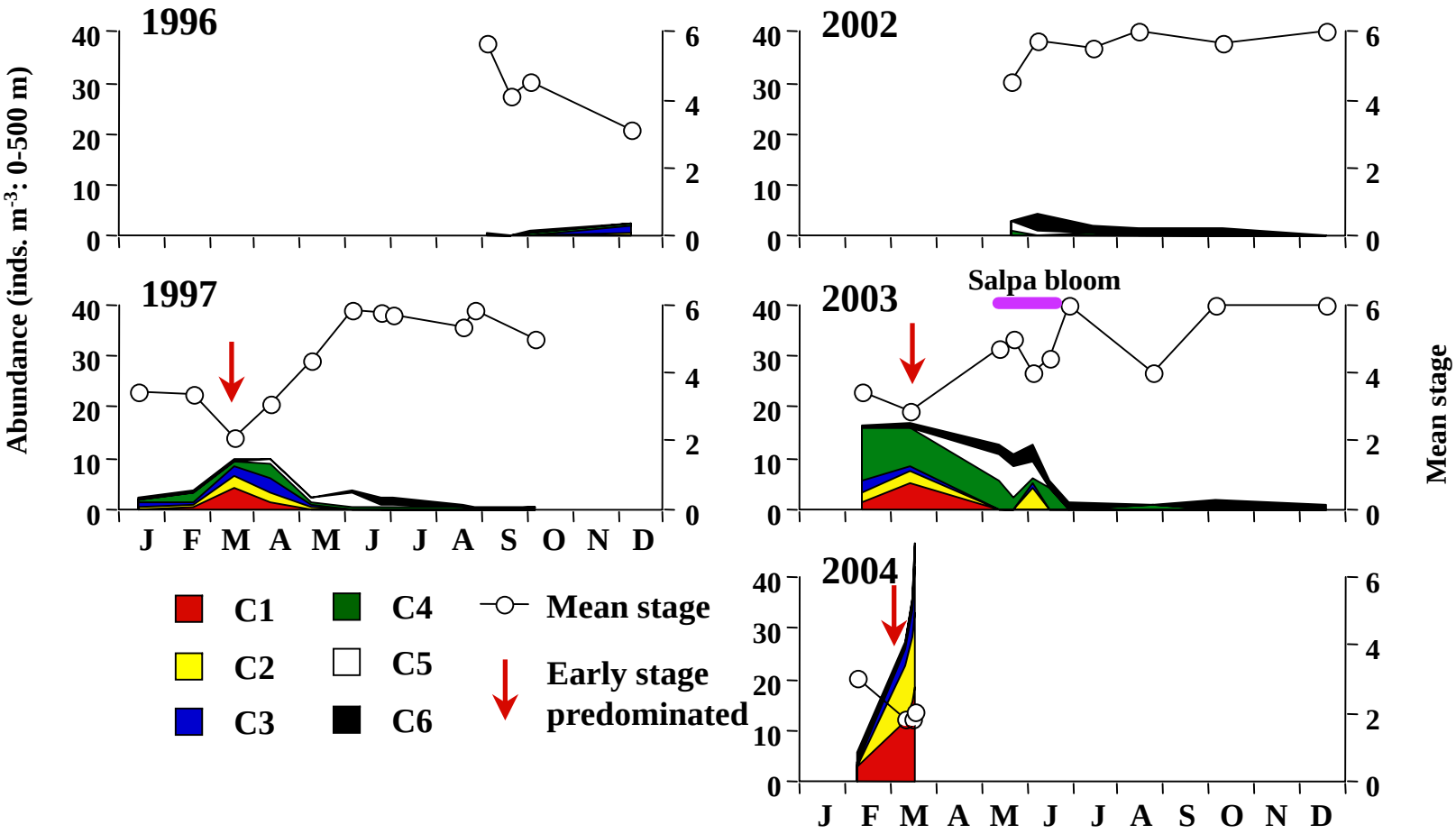
Only one peak of recruitment of early copepodids in a year.
The recruitment season of early copepodids stable across the years studied.
Salpida bloom (May-June 2003) reduced the abundance of *Eucalanus bungii* .

Neocalanus cristatus



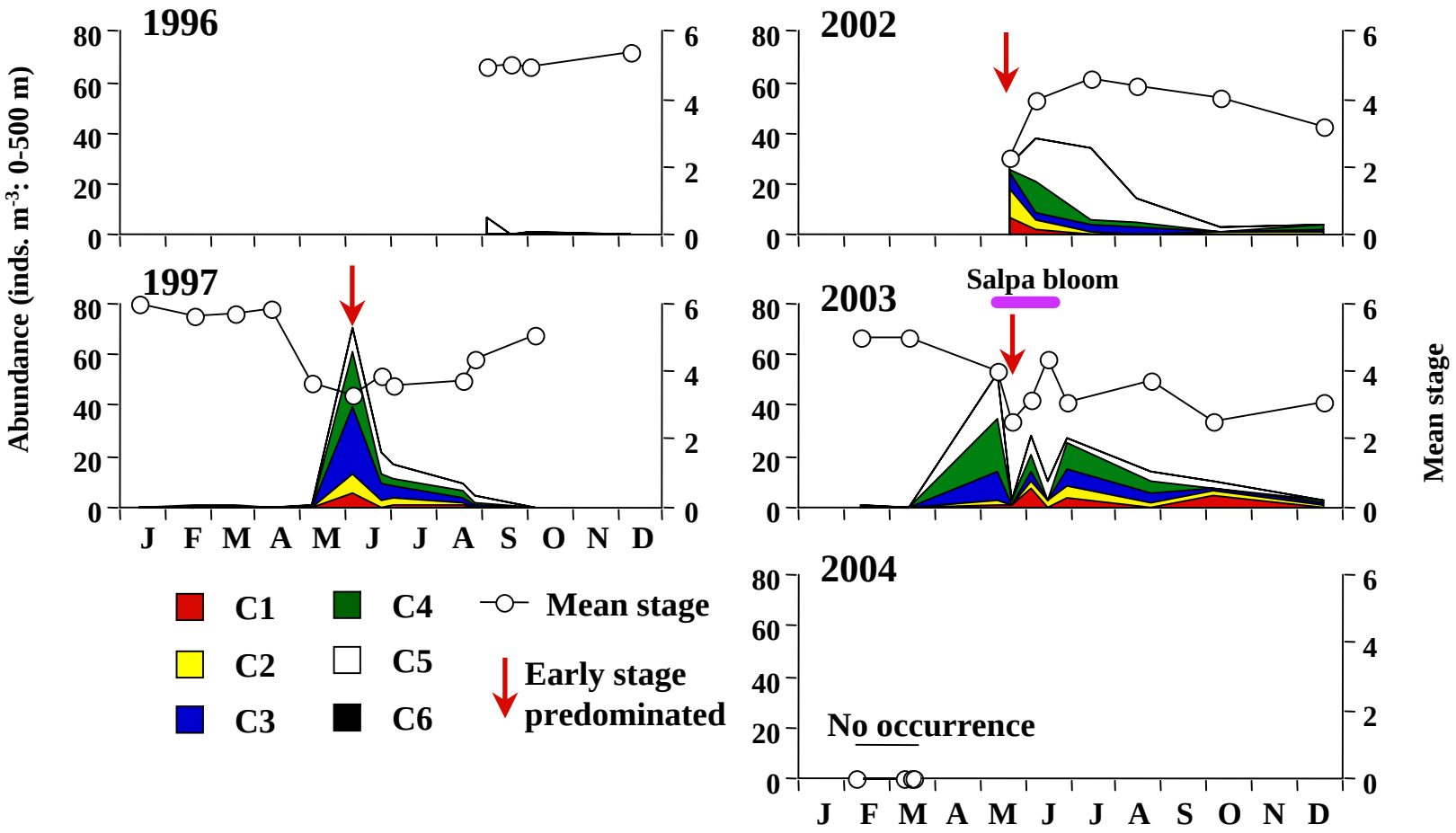
One peak of recruitment of early copepodids in a year.
The recruitment season was in December-January in each year studied.

Neocalanus flemingeri



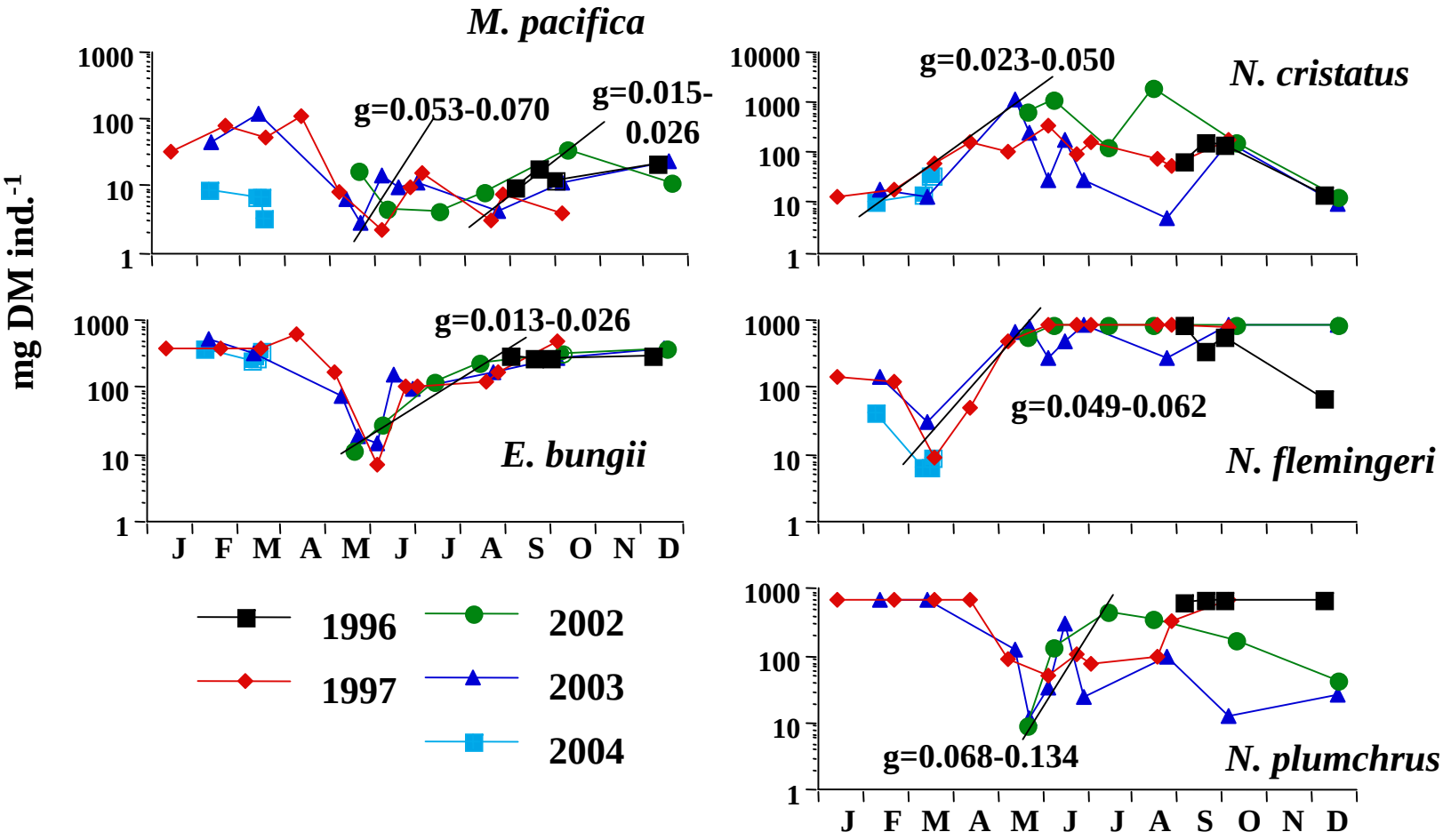
One peak of recruitment of early copepodids in a year.
The recruitment season was March across the years studied.

Neocalanus plumchrus



One peak of recruitment of early copepodids in a year.
The recruitment season was May across the years studied.
Salpida bloom (May-June 2003) reduced abundance of *Neocalanus plumchrus*.

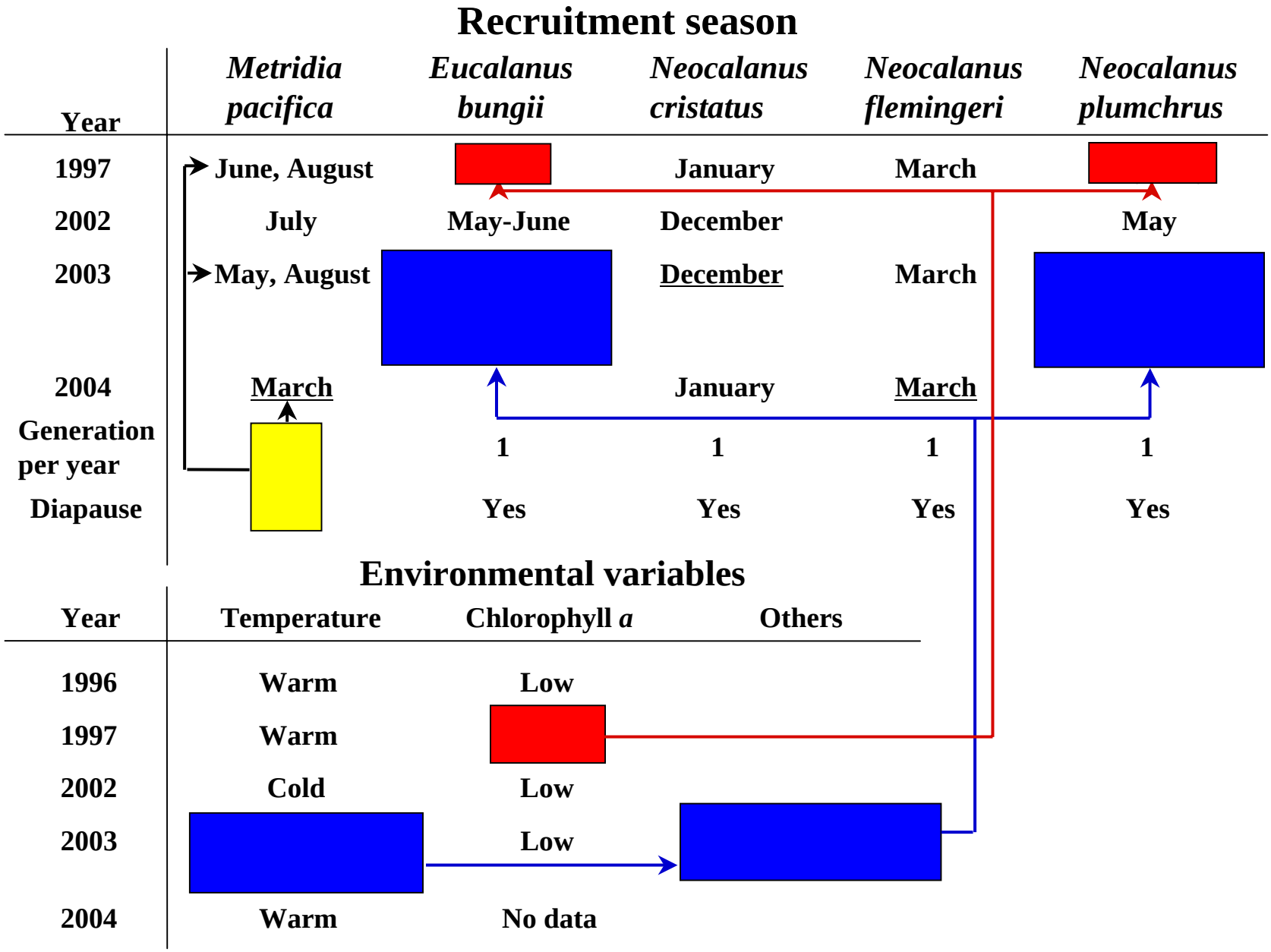
Apparent population growth rate $g = (\ln W_{t1} - \ln W_{t0}) \cdot D^{-1}$



Growth rates of a given copepod less variable with year.

***: Stage-specific dry mass data from Kobari et al. (2003), Shoden (unpublished), Padmavati (unpublished).**

Environmental condition vs. recruitment timing



Summary

1. **Temperature appeared to affect little to the developmental timing and growth rates of copepods (especially one-year life cycle species).**
2. **The incidence of salp blooms in 2003 reduced the abundance of *N. plumchrus* and *E. bungii*, suggesting possible food competition between young copepodids of these two species and salps.**
3. **Abundance of *N. plumchrus* and *E. bungii* was correlated with magnitude of spring phytoplankton bloom of that year, indicating that food supply is an important factor which determine the population size of these copepods.**
4. **The presence of interannual variations in the recruitment season in *M. pacifica* may be interpreted by the shorter generation length, no diapause phase, and close coupling of feeding and spawning of this species as compared with the other species.**