

Marine phytoplankton viruses

Ecology, physiology and host-
virus interactions

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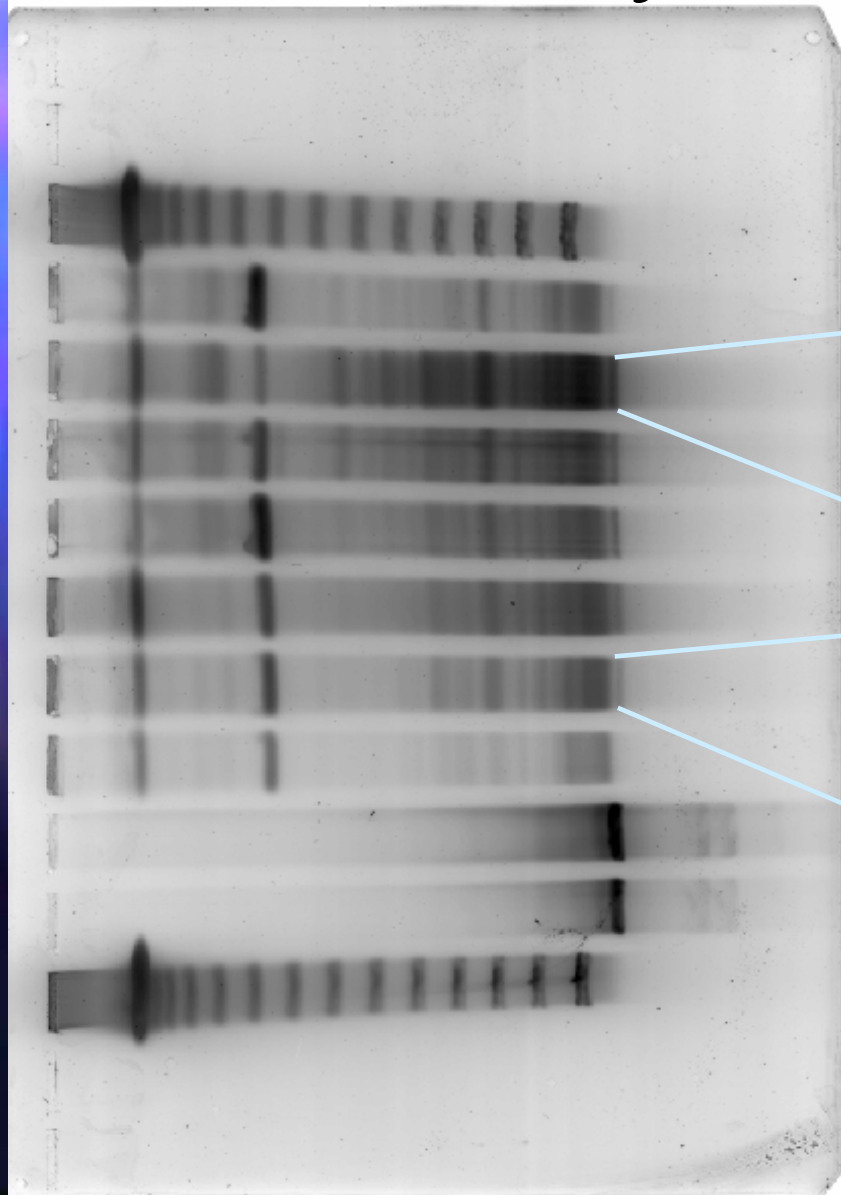


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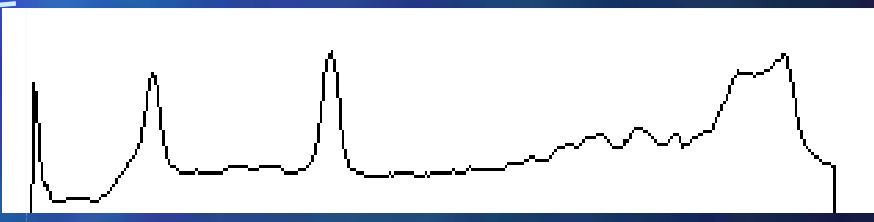
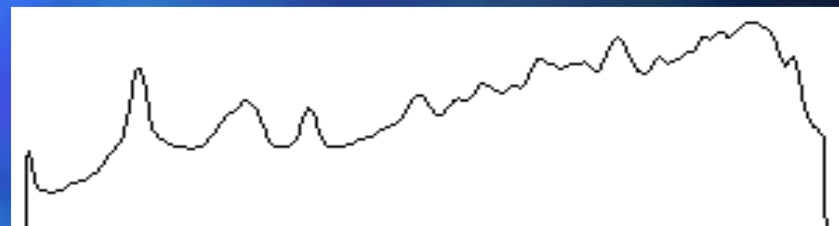
Ecology, physiology and host-virus interactions

- Abundance and diversity
 - Flow Cytometry (FCM) & Pulsed Field Gel Electrophoresis (PFGE)
 - Mesocosms
- Experimental results
 - cell cycle dependent virus production
 - co-existence of virus and algal host

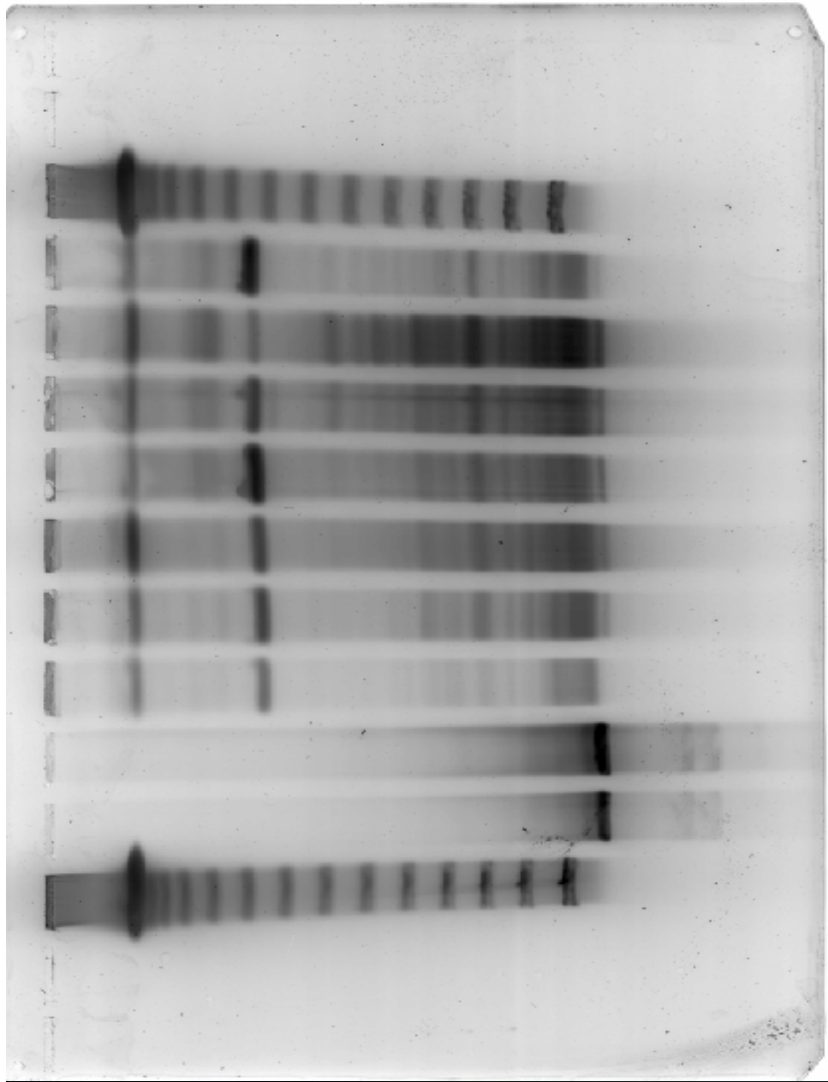
PFGE analysis



Band intensity



- # of bands
- band position



ladder2

24/6

23/6

22/6

21/6

20/6

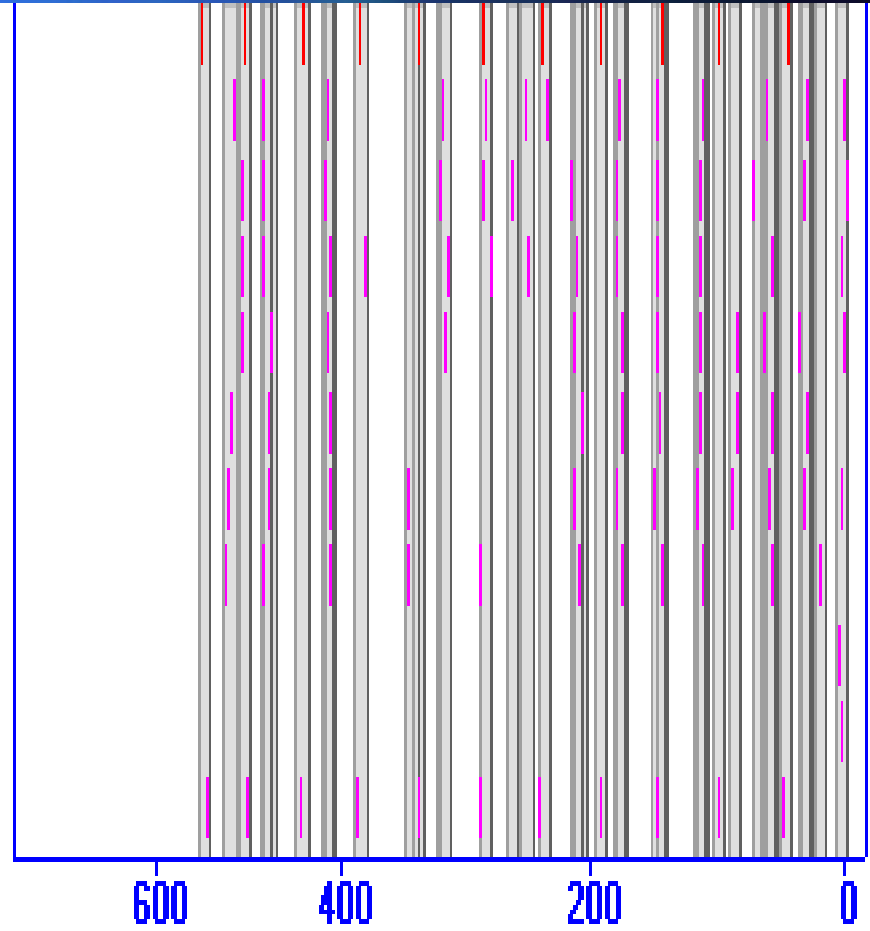
19/6

18/6

hind2

hind1

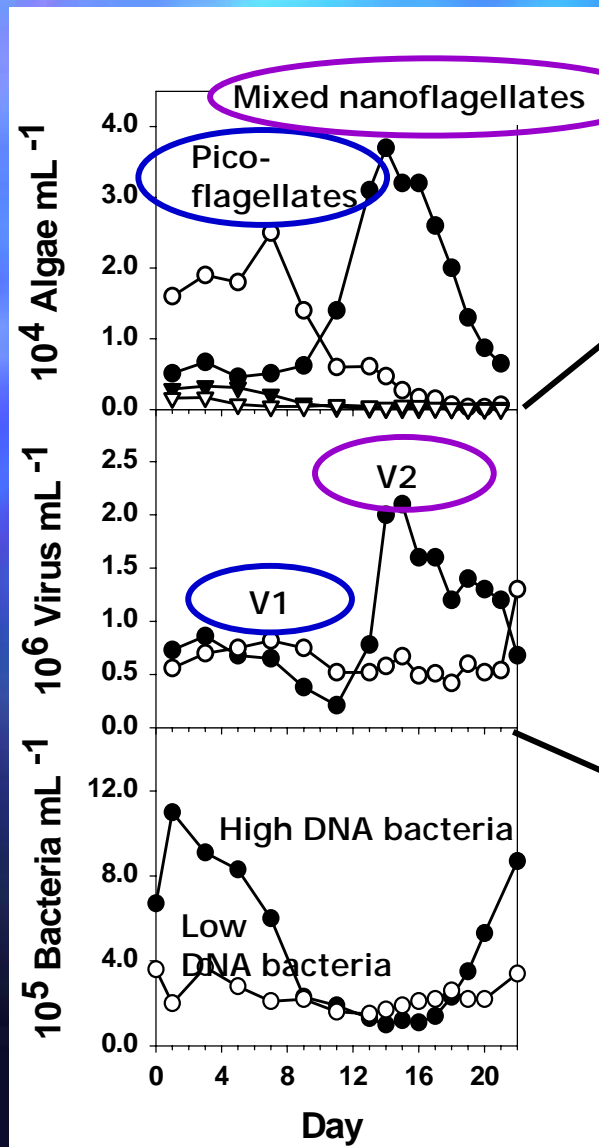
ladder1



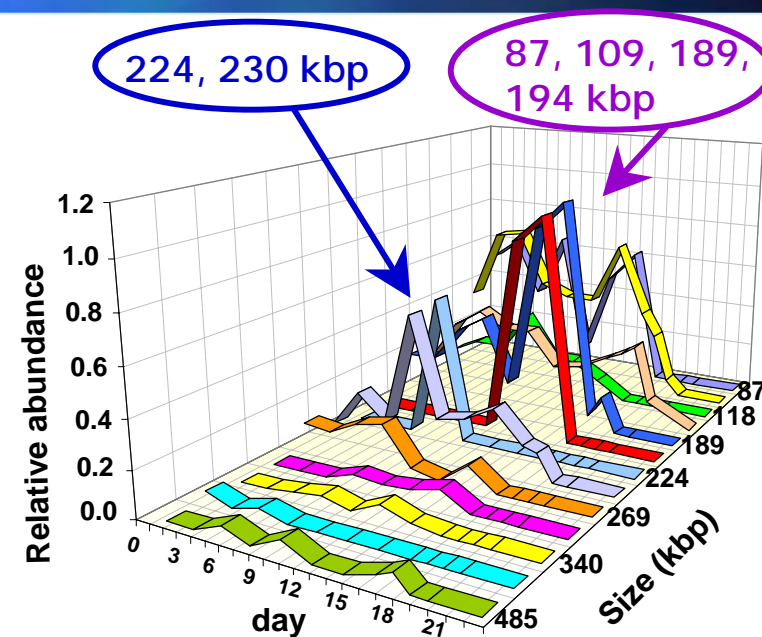
kbp

Algae, virus & bacteria in a mesocosm

Abundance determined by FCM

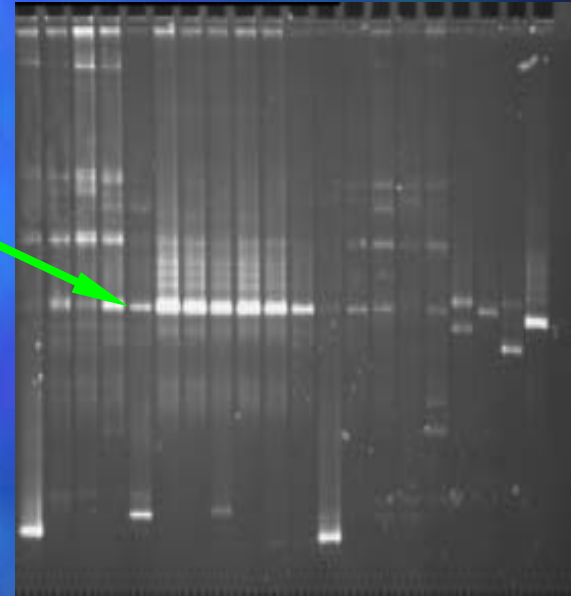
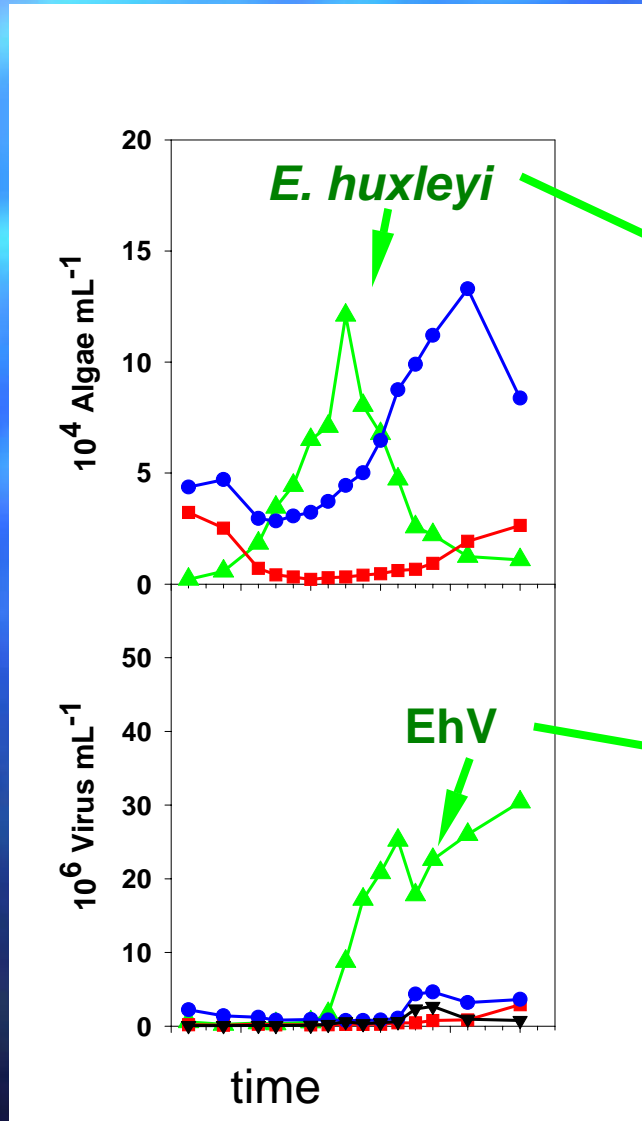


Viral diversity determined by PFGE

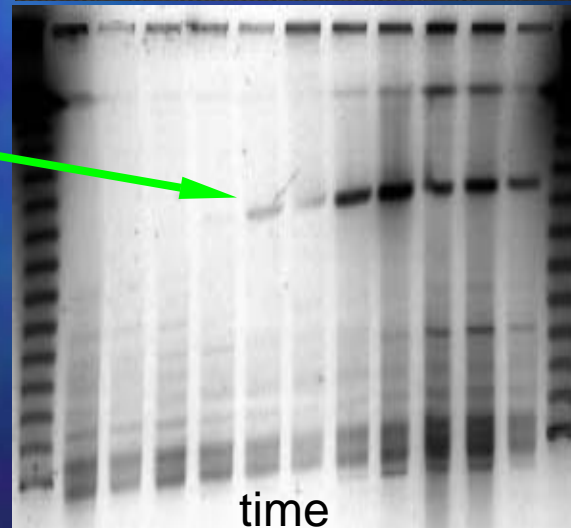


Viral termination of *E. huxleyi*

Abundance determined by FCM

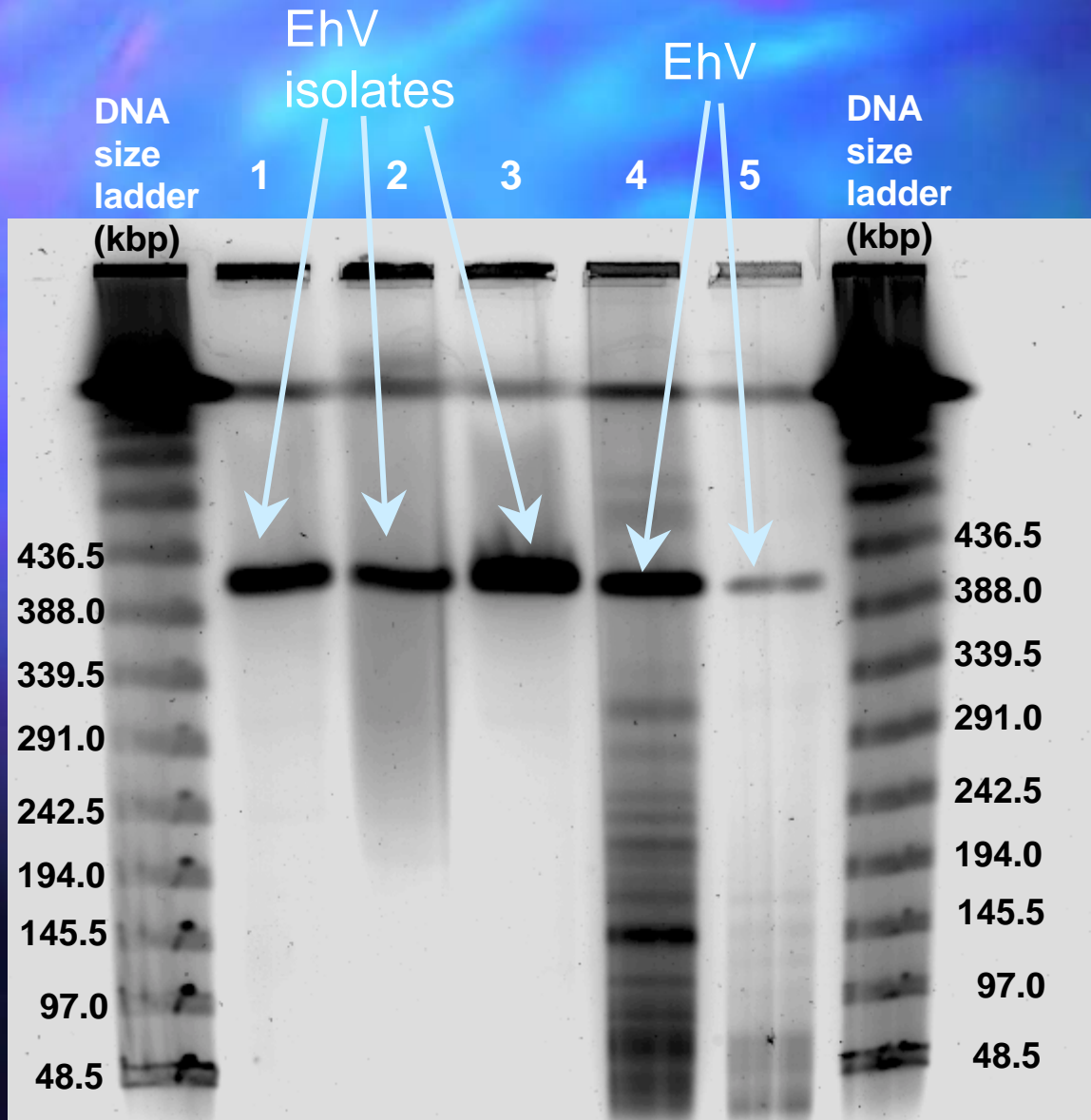


Eukaryotic diversity determined by 18S rDNA DGGE



Viral diversity determined by PFGE

Emiliana huxleyi virus (EhV) in mesocosms (PFGE)



1: isolate - bloom 1999

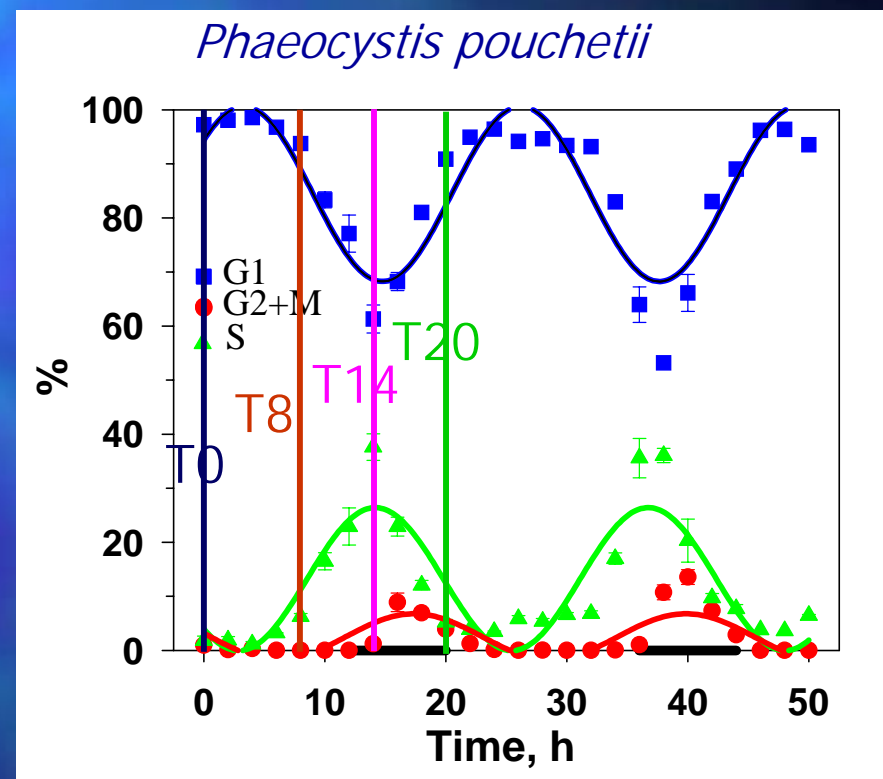
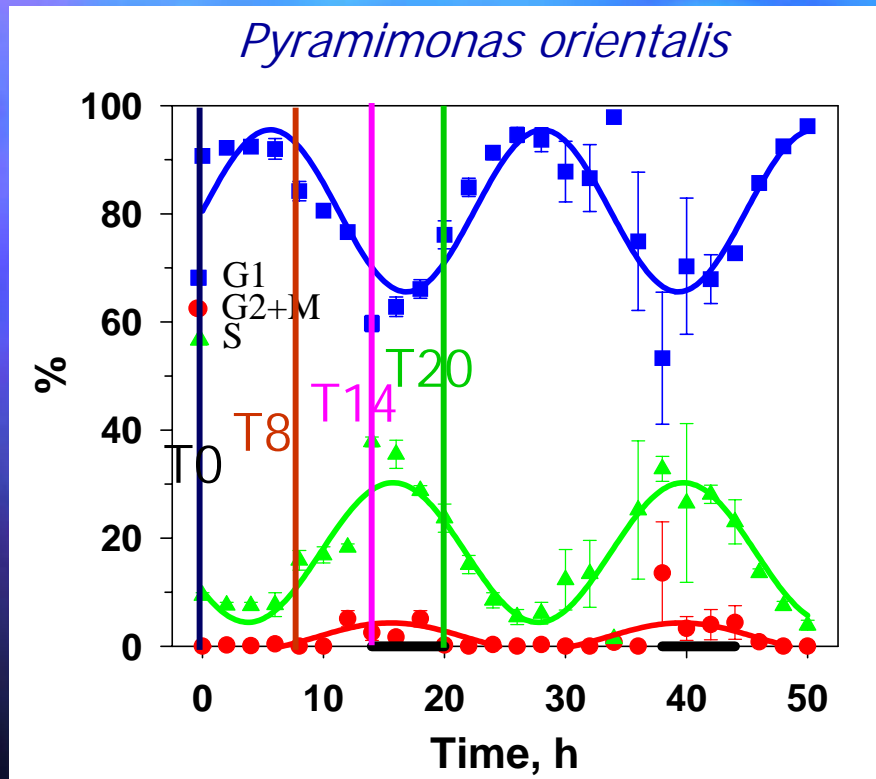
2: isolate - prebloom 2000

3: isolate - postbloom 2000

4: mesocosm sample 2000

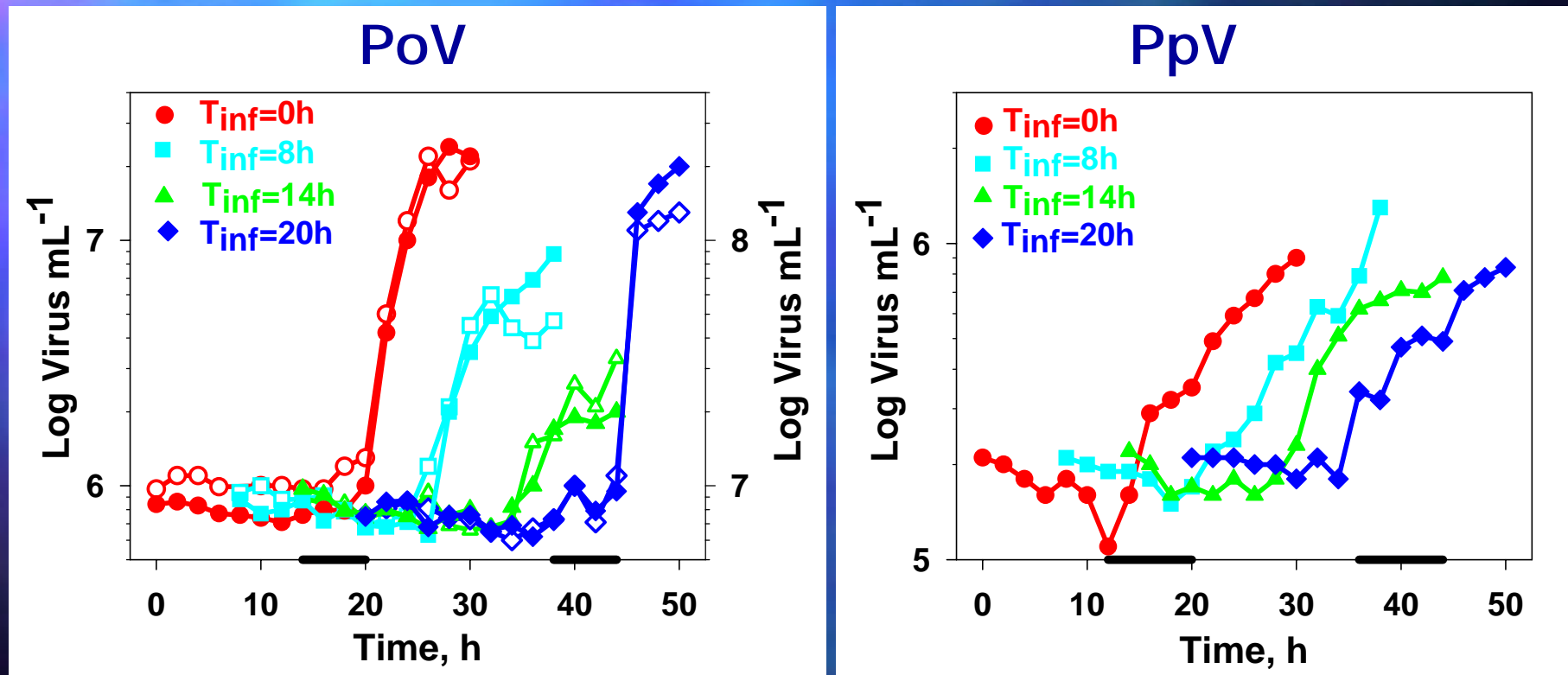
5: mesocosm sample 2001

Cell cycle dependent virus production?



P. orientalis and *P. pouchetii* infected with PoV and PpV, respectively

Cell cycle dependent virus production



P. orientalis infected at T0 and T20 produced more PoV than when infected at T8 and T14

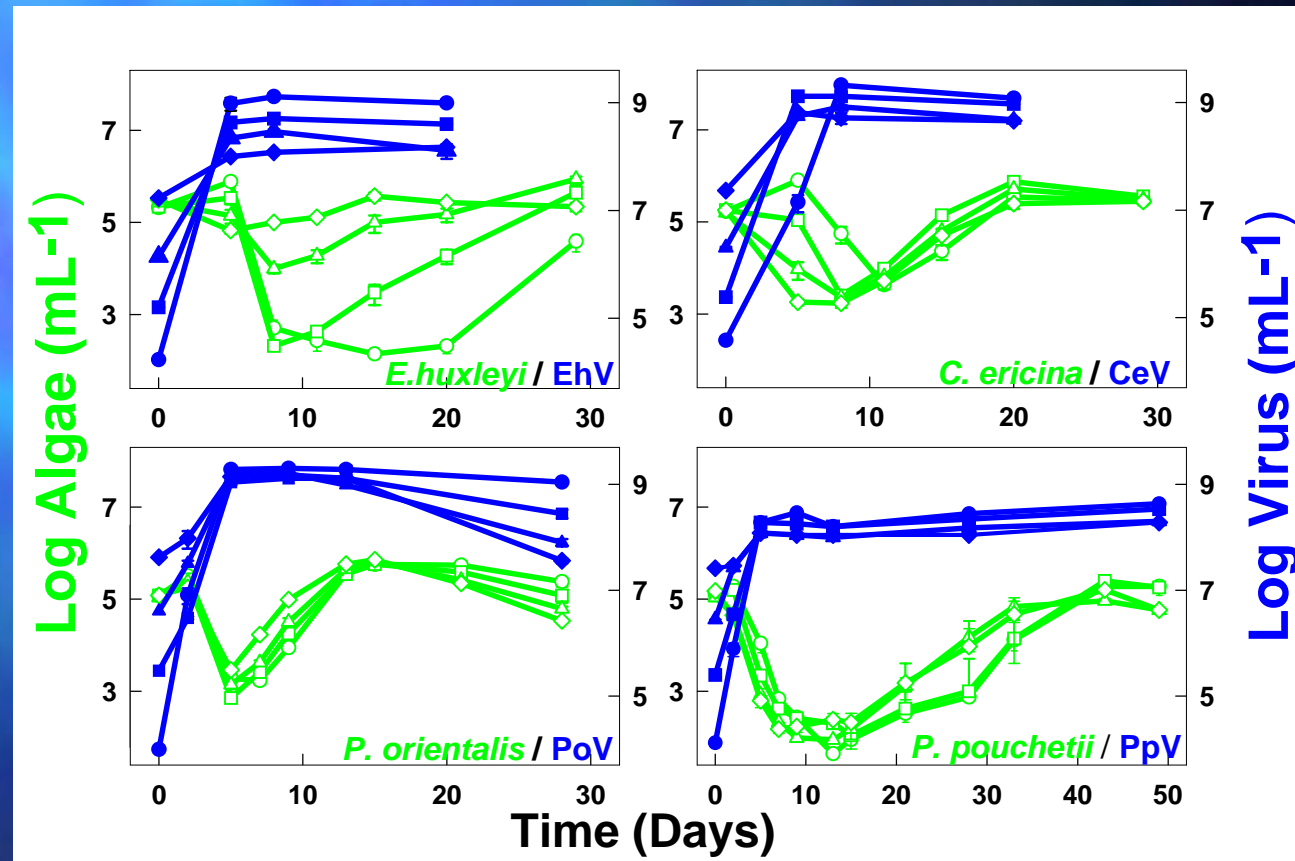
P. pouchetii infected with PpV - virus production not dependent on time of infection

Cell cycle dependent virus production or not - ecological implications

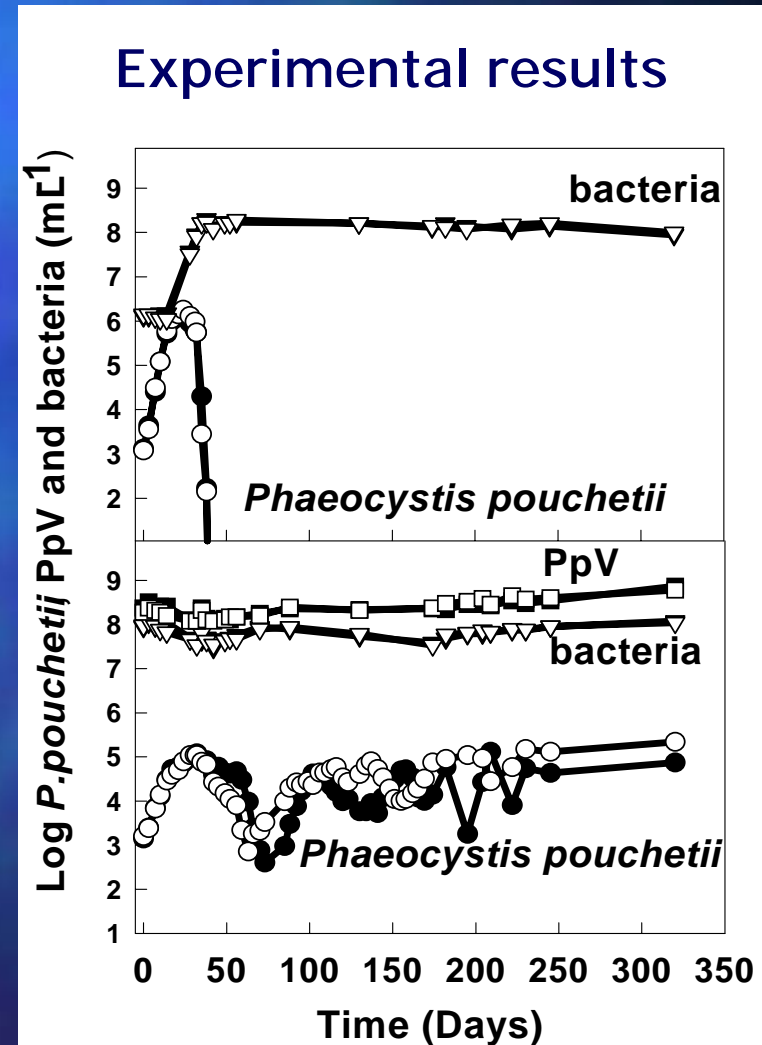
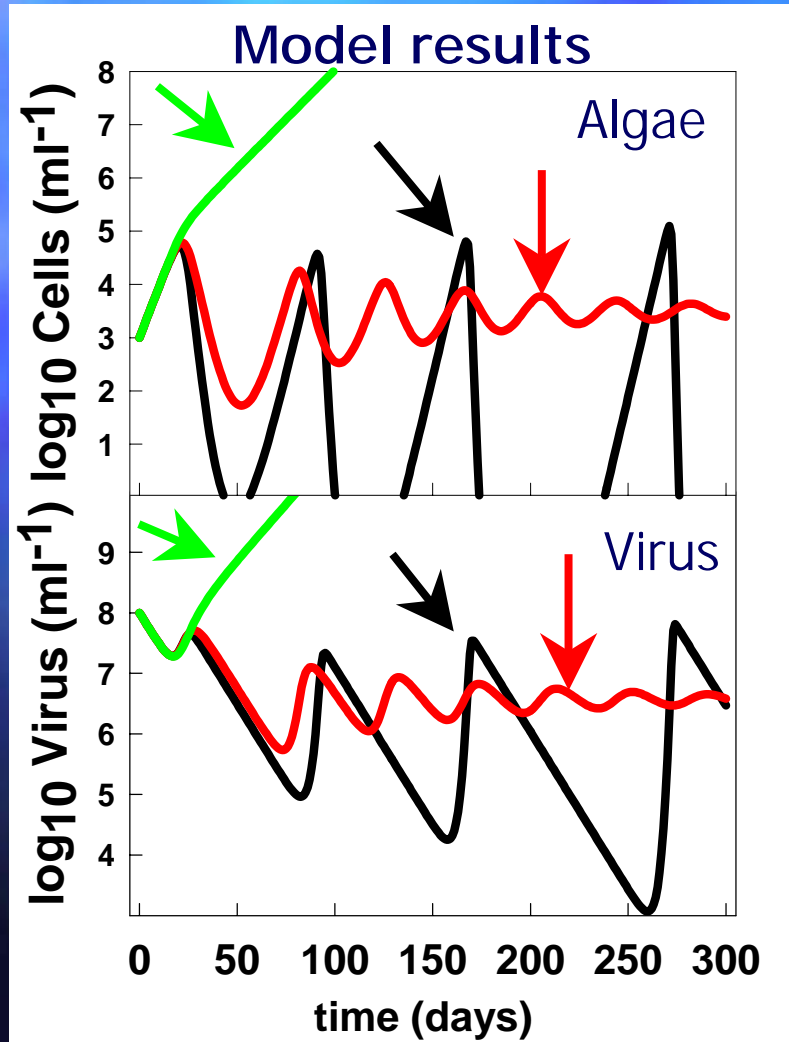
- PoV production - dependent on diel light variations - controlled by host cell cycle?
- PpV production - independent of diel light variations - overrules host cell cycle?
- Different strategies for virus replication - different ecological significance for host?
- *P. orientalis* - not bloom forming
 - PoV stabilizes host - virus interactions?
- *P. pouchetii* - bloom forming
 - PpV terminate blooms?

Stable coexistence in algae-virus systems

- Lysed algae cultures recover after 5-10 days
- Sub-cultured "resistant" algae continue to produce virus
- Addition of fresh virus - no lysis in "resistant" algae culture
- Virus from "resistant" culture - infect fresh algae culture



- Rate and extent of lysis in algal cultures were reduced when treated with 0.02 μ m filtered virus lysate (=virus free lysate)
- Hypothesis: Filterable cues act as viral inhibitors



Stable coexistence in algal-virus systems

- Algal cultures recover after viral lysis and become resistant to new infections
- Algae and virus co-exist for at least one year in cultures
- Hypothesis: Filterable cues act as viral inhibitors
 - inverse co-variation between viral absorption rate and viral abundance
- Ecological significance:
 - prevents algae from extinction
 - regeneration of nutrients - prevents nutrient depletion
 - allows co-existence at high and low host densities

Marine phytoplankton virus

- Field work:
 - Control algal populations
 - Terminate algal blooms
- Experiments:
 - Different algal viral replication strategies (cell cycle dependence or independence) - different ecological significance (bloomers/non-bloomers)
 - Resistant strategy - allows coexistence of host and virus

Co-workers

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