DIEL DYNAMICS IN VIRIOPLANKTON ACTIVITY

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Abstract

Changes in resources availability can influence the production of bacteria at a diel scale and might consequently also generate short-term modifications in viral lysis rates. We examined the diel changes of viral production every 4-8 h in relation to bacteria activity in three water masses of the North Sea during July 2003. Viral activity was highest at all stations during dawn, ranging from $7.7x10^5$ ml^{-1} h^{-1} to $55.1x10^5$ ml^{-1} h^{-1} but did not follow the dynamics in bacterial production. The results indicate that viral lysis does not exhibit pronounced diel dynamics in the North Sea.

Key words: viral production, bacterial growth rate, diel cycle

Introduction

Recognition of viruses as the most abundant component of aquatic microbial communities has generated scientific interest focusing on their impact on the dynamics of host communities. Diel patterns in planktonic activity might be reflected in associated dynamics of the respective viral component, however, this has not be investigated yet [1, 2]. While bacterioplankton abundance and biomass remain usually fairly stable, their activity changes at a scale of hours [3, 4]. As viral production depends on bacterial activity, we hypothesized that diel dynamics in bacterial production should be reflected in short-term changes of viral lysis.

Materials and Methods

We sampled surface waters of the North Sea at three drifting stations during summer (July 2003) every 4-8 h for a total period of 28-48 h. Viral production was estimated using the virus-dilution approach [5, 6]. Bacterial activity was measured via [^{14}C]-leucine incorporation. Bacterial and viral abundance was determined in duplicate by flow cytometry.

Results and conclusion

Viral abundance averaged $21x10^7$ ml^{-1} at the southern station, $10x10^7$ ml^{-1} at the central station and $8x10^7$ ml^{-1} at the northern station of the North Sea. Viral abundance displayed short-term oscillations but not a diel trend. Viral production ranged from $1.8x10^4$ to $5.5x10^6$ ml^{-1} h^{-1} at the southern station (Fig. 1), from $7.7x10^3$ to $1.0x10^6$ ml^{-1} h^{-1} at the central station (Fig. 2) and from $6.4x10^4$ to $3.3x10^5ml^{-1}$ h^{-1} at the northern station. The highest values of viral lysis were recorded around dawn in all the stations.

The range of bacterial abundance and activity, respectively, was $5.9x10^5$ ml^{-1} and 0.94 -3.1 nmol Leu $l^{-1}d^{-1}$ at the southern station, $4.6x10^5$ ml^{-1} and 0.13-1.63 nmol Leu $l^{-1}d^{-1}$ at the central station and $3.0x10^5$ ml^{-1} and 0.85-1.33 nmol Leu $l^{-1}d^{-1}$ at the northern station. Bacterial activity was slightly lower during the night in all the stations. Bacterial growth rate was 0.11-0.46 d^{-1} at the southern station (Fig.1), 0.06-0.24 d^{-1} at the central station and 0.20-0.34 d^{-1} at the northern station.

Pronounced diel dynamics in the viral activity were not detectable, probably due to the low diel dynamics in bacterial activity in the mesotrophic North Sea. More pronounced diel patterns in bacterioplankton growth has been reported for oligotrophic systems such as the Mediterranean Sea.

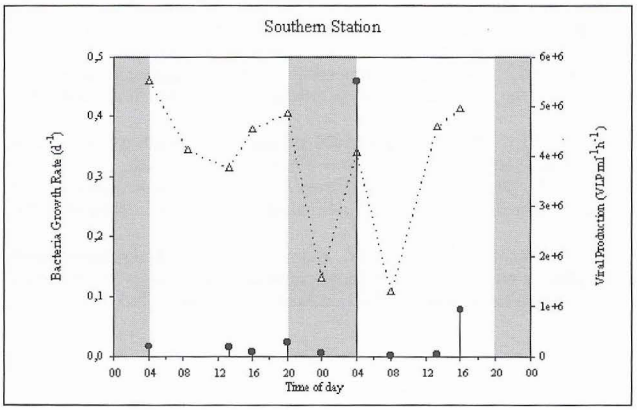

Fig. 1. Dynamics of bacterial growth rates (triangles) and viral production (circles) at the Southern Station of the North Sea.

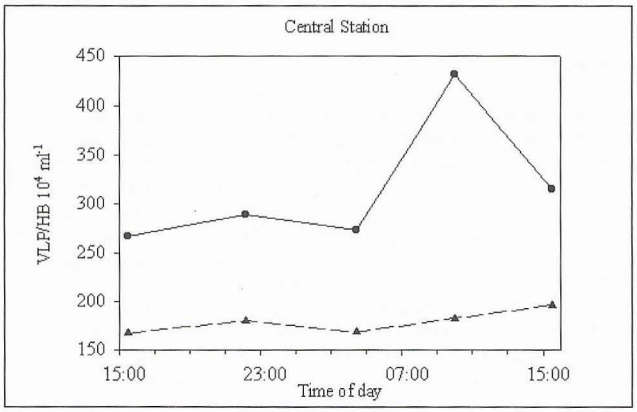

Fig. 2. Dynamics of virus like particles (VLP, circles) and heterotrophic bacterial (HB) abundance during incubation of water from 13:15 h at the Central station.

References

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