To kill or not to kill: The balance between lytic and lysogenic viral infection is driven by trophic status

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ABSTRACT: Experiments were conducted to investigate spatiotemporal patterns in lytic and lysogenic viral infection using water samples collected on the Canadian Arctic Shelf, southern Beaufort Sea. Viral production (VP) and viral-induced mortality of bacteria (VMB) were determined using a viral reduction approach during a full seasonal cycle, while the percentage of lysogenic bacteria (PLB) in spring and summer was determined in virus-reduced samples by induction with mitomycin C. Overall, VP (range: $0.3 \times 10^9 - 77 \times 10^9$ viruses L^{-1} d^{-1}), VMB (range: $0.2 \times 10^7 - 43 \times 10^7$ bacteria L^{-1} d^{-1}), and PLB (range: 4–38%) displayed marked spatiotemporal variations concomitant with changes in chlorophyll *a*, bacterial abundance, and production. Highest VP and VMB occurred in summer when the water was warmest, stratified, and most productive, and when viruses removed up to 29% of bacterial standing stock d^{-1} and released up to 4.3 µg of organic carbon L^{-1} d^{-1}. In contrast, the highest PLB occurred in spring when the water was colder, well mixed, and oligotrophic. Correlative and regression analyses indicated viral lytic and lysogenic variables were significantly coupled with chlorophyll *a* and the abundance, production, and growth rate of bacteria, implying that viral lytic and lysogenic lifestyles were dependent on system productivity. Furthermore, lytic VP and the proportion of lysogenized bacteria were inversely related, suggesting a dynamic interplay between viral infection pathways. Lytic infection was more pronounced when system productivity was high, while lysogeny prevailed when system productivity was low. These data demonstrate the important role of viruses in bacterial mortality and carbon cycling in the Arctic Ocean, and show how their effect is influenced by trophic status.