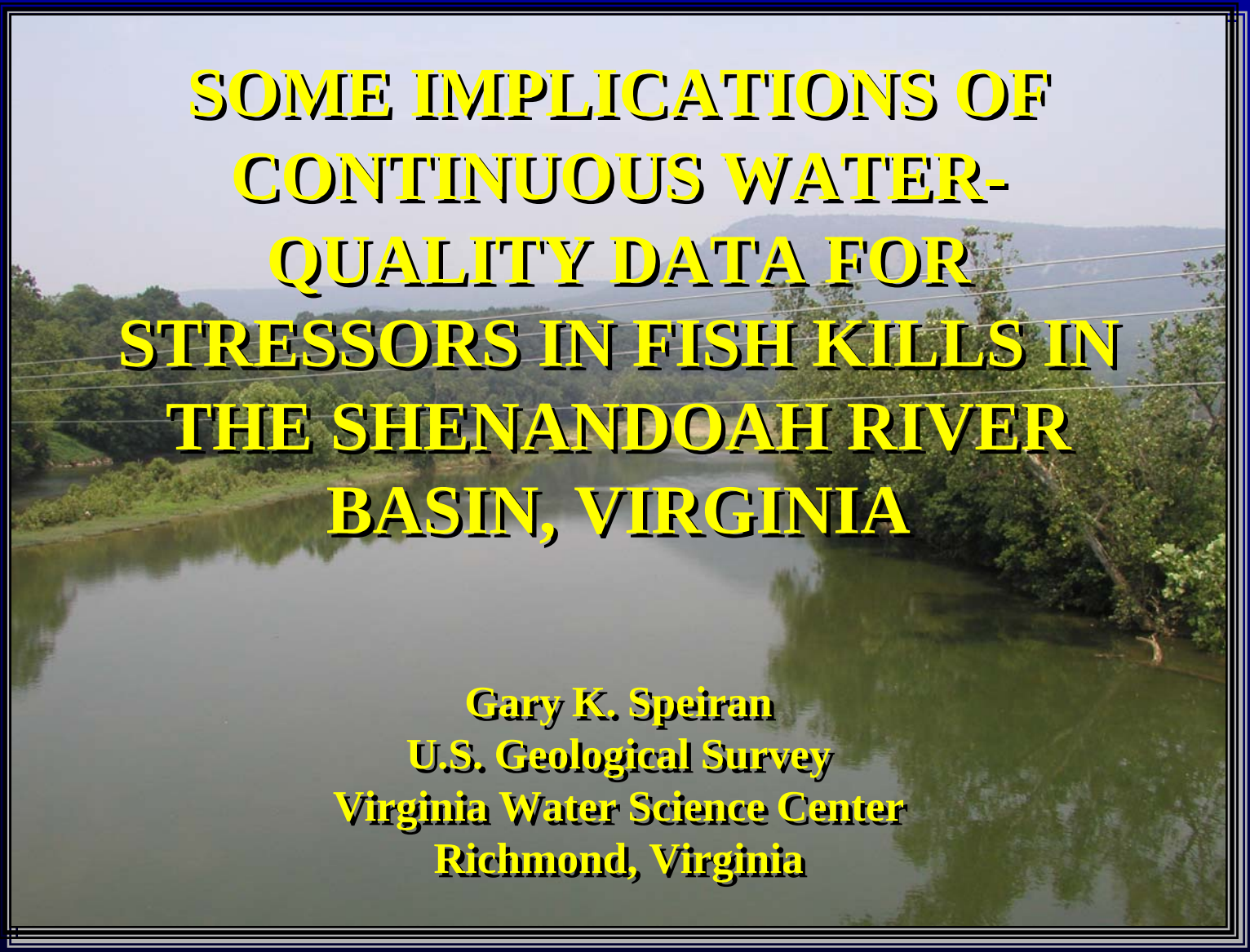

SOME IMPLICATIONS OF CONTINUOUS WATER-QUALITY DATA FOR STRESSORS IN FISH KILLS IN THE SHENANDOAH RIVER BASIN, VIRGINIA

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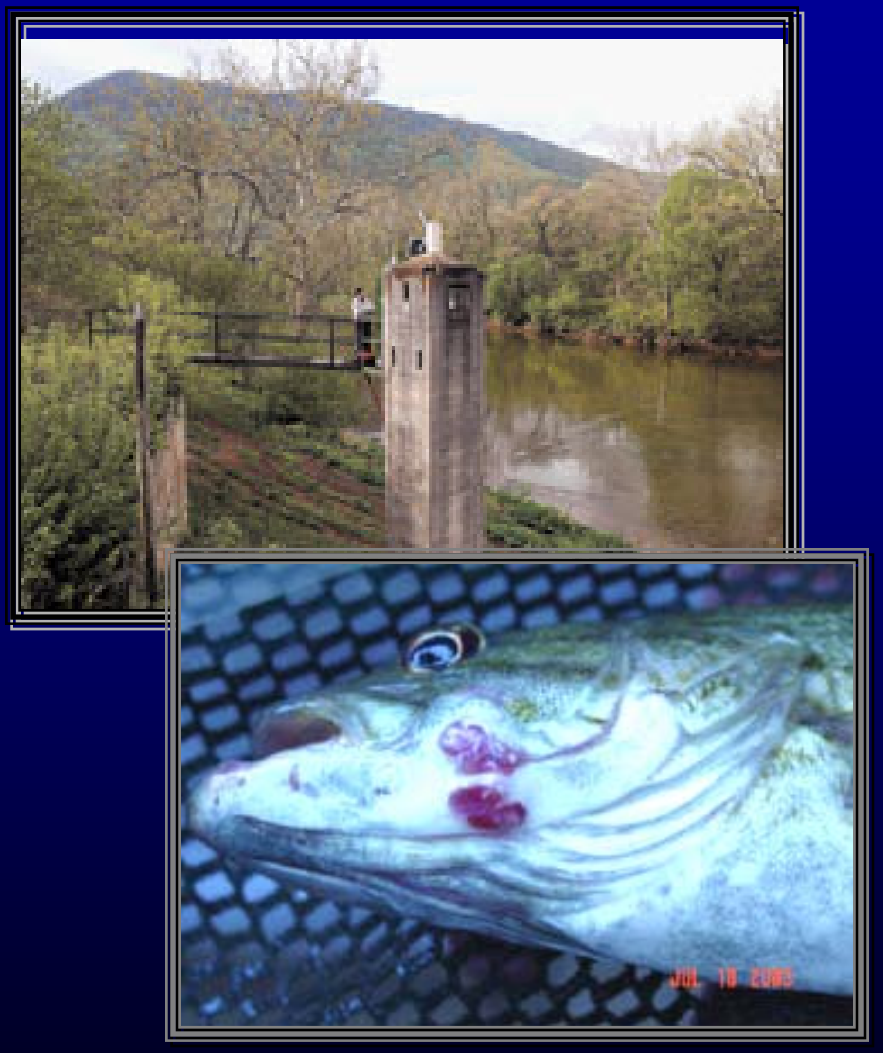
science for a changing world

STUDY PURPOSE

- Evaluate the possibility that short-term changes in ammonia concentrations might be one of the stressors contributing to fish kills in the Shenandoah River Basin



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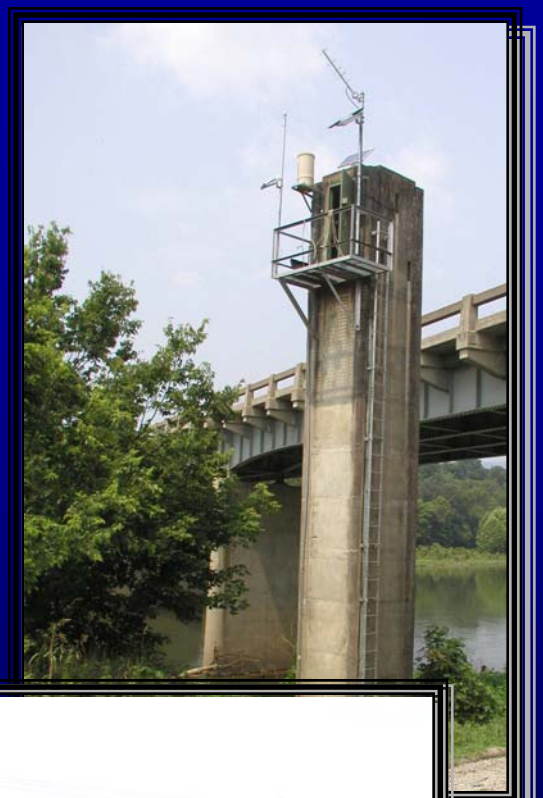
GOALS OF PRESENTATION

- Types and magnitudes of water-quality changes: diurnal and responses to changes in streamflow.
- Possible implications of these changes for stressors on fish.



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WHY THESE CHANGES MIGHT BE IMPORTANT!!

- Combination of chronic conditions and various duration episodic changes.
- Uncertain stress response of exposure to these types of water-quality change.
- Uncertain how long after exposure for lesions to appear and for fish to die.

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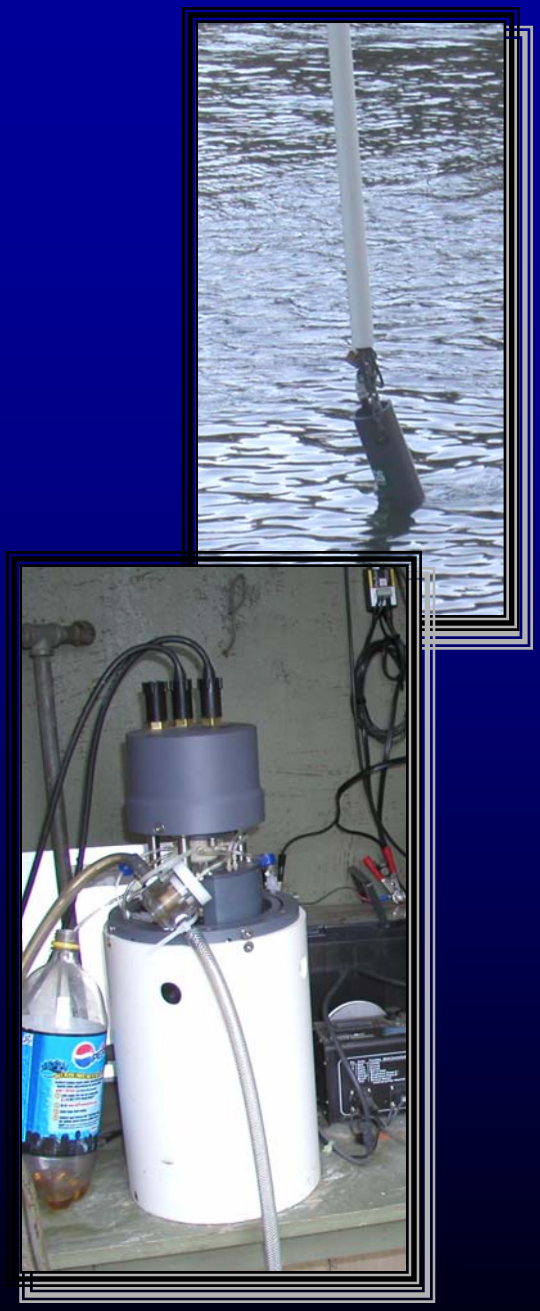
CONTINUOUS MONITORING

- Water temperature, pH, specific conductance, dissolved-oxygen concentration, and turbidity using a multi-parameter sonde.
- Ammonia nitrogen using a water-quality monitor that uses laboratory-equivalent methods adapted for field application.



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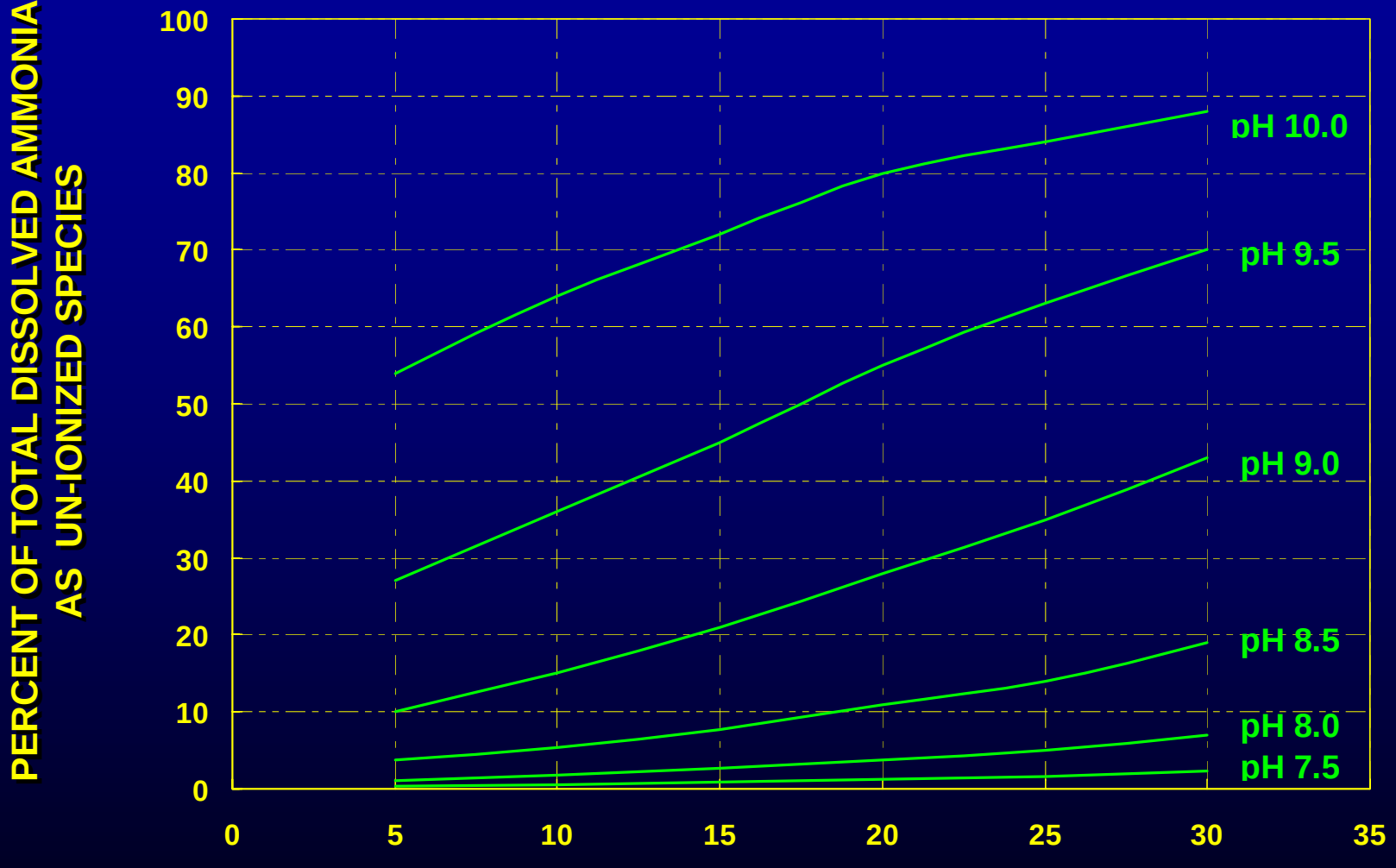
PERCENT OF TOTAL AMMONIA AS UN-IONIZED SPECIES AT INDICATED WATER TEMPERATURE AND PH



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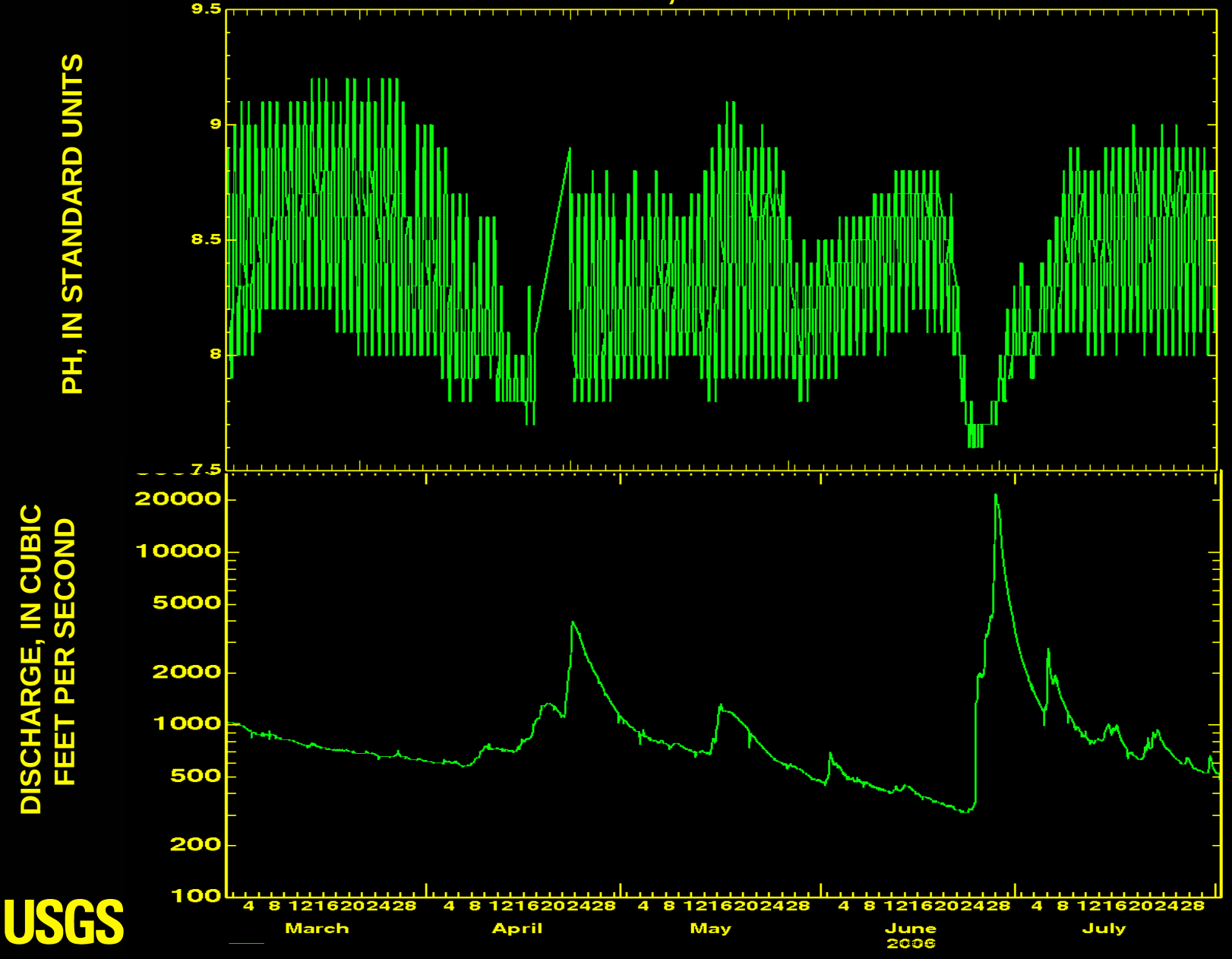
COMPARISON OF STREAM DISCHARGE AND PH, SOUTH FORK SHENANDOAH RIVER NEAR LURAY, MARCH THROUGH JULY 2006



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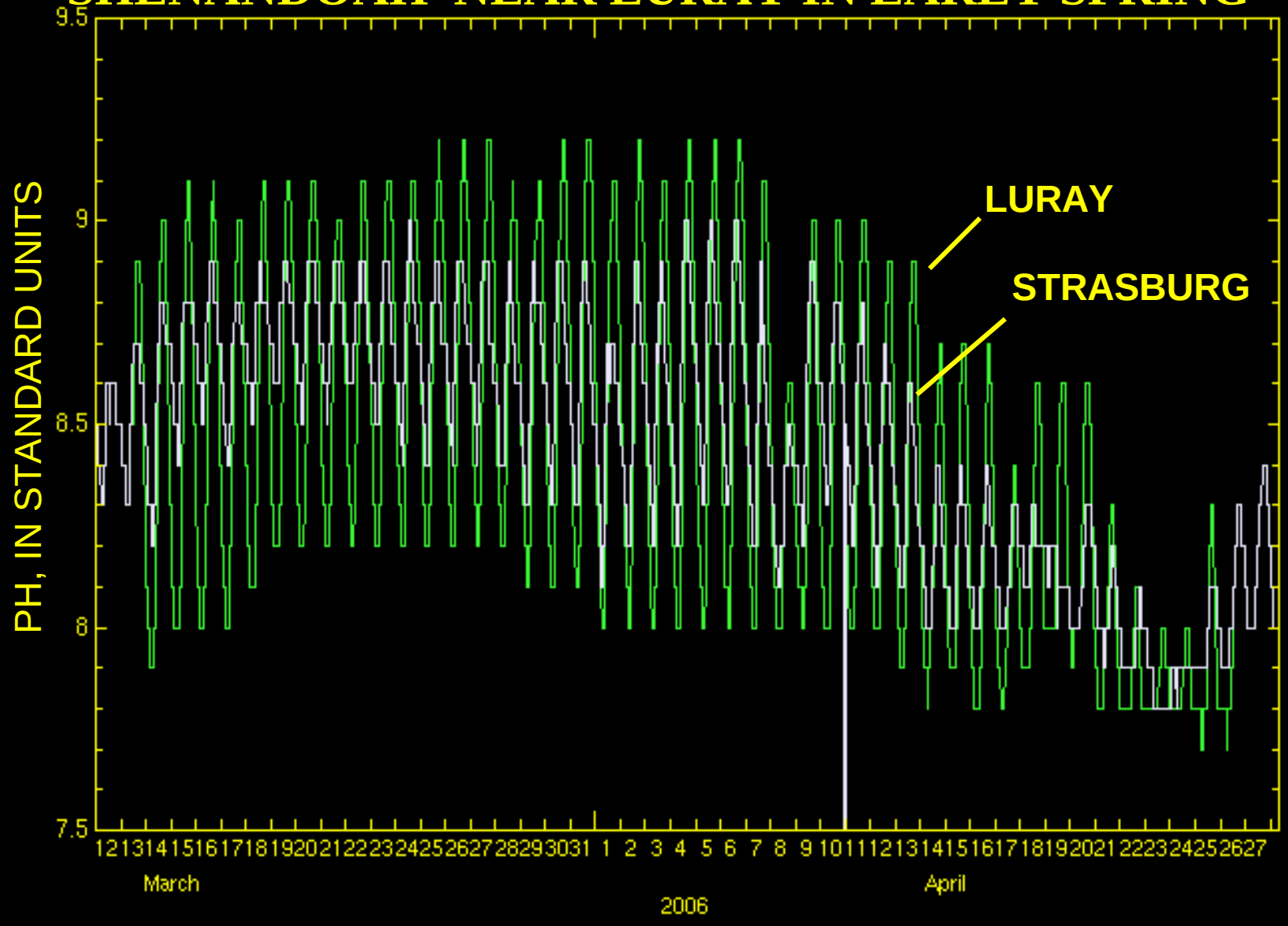
COMPARISON OF PH, NORTH FORK SHENANDOAH RIVER NEAR STRASBURG AND SOUTH FORK SHENANDOAH NEAR LURAY IN EARLY SPRING



SPECIFIC CONDUCATANCE AND PH IN RELATION TO STREAMFLOW AT SOUTH FORK SHENANDOAH RIVER NEAR LURAY, SUMMER 2006

- Diurnal pH changes and daily maximum values are slightly less in the summer than in the early spring
- Specific conductance remains elevated during some periods of increased streamflow.

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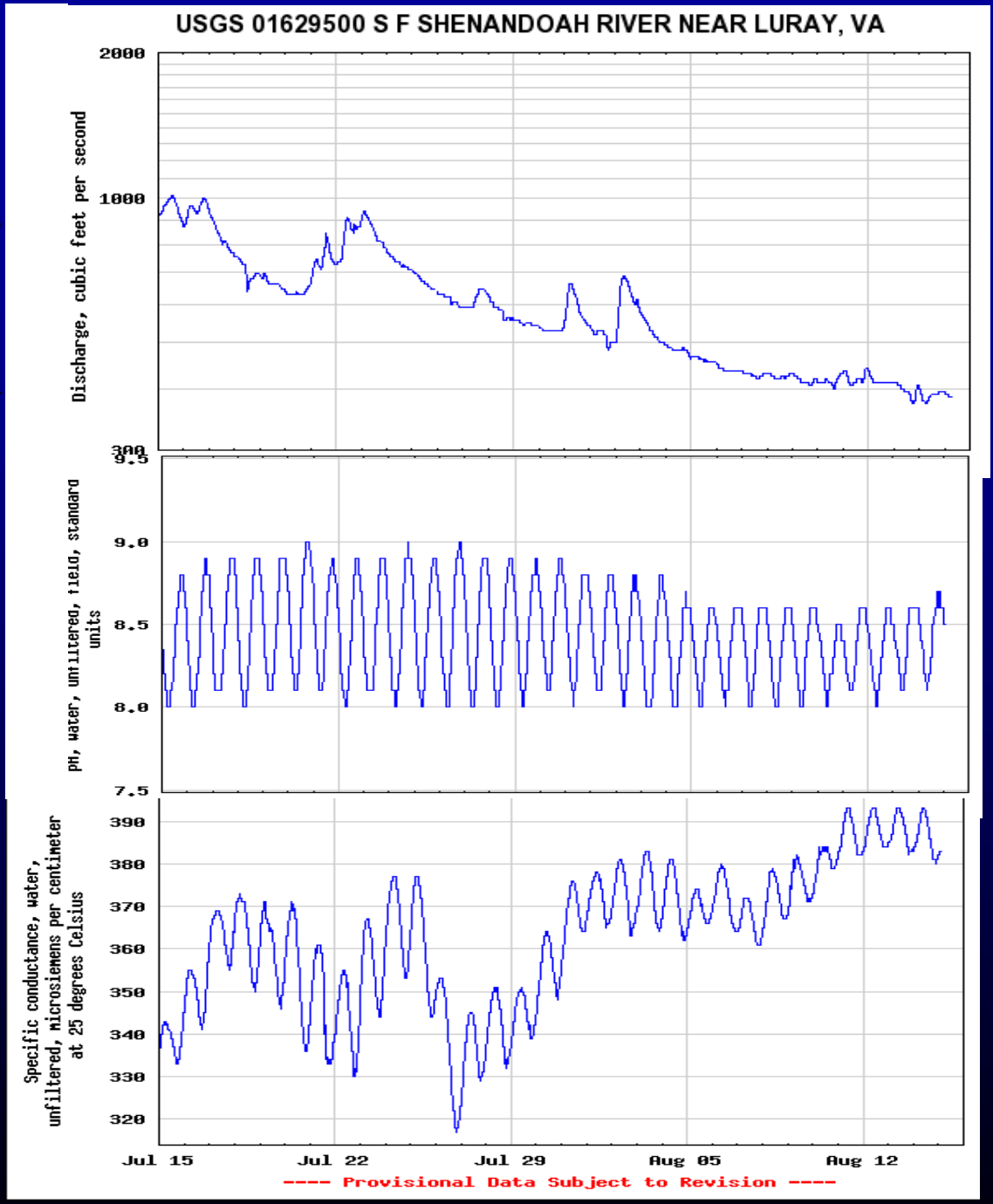

Relation of Ammonia Concentrations to Streamflow

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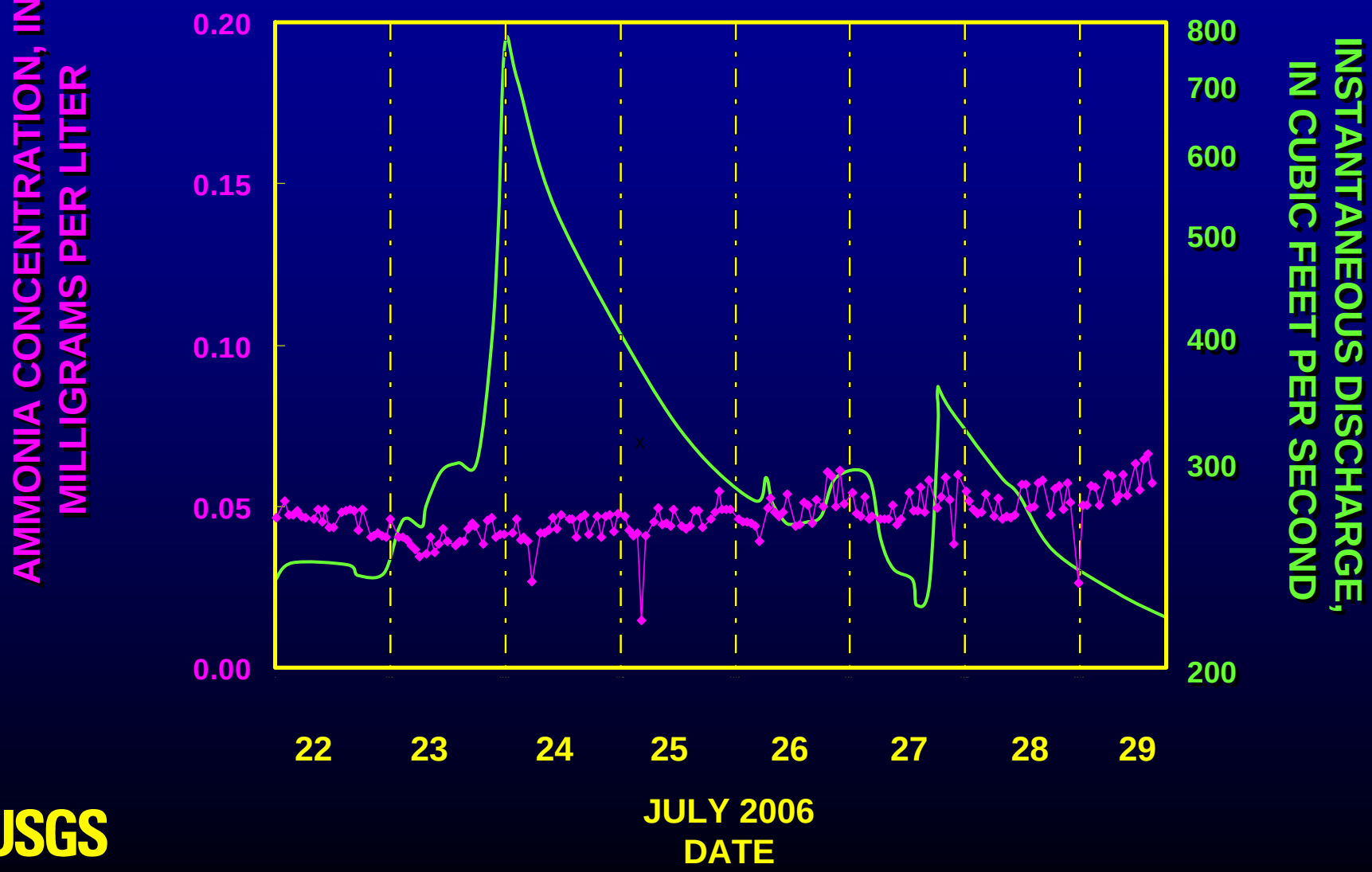
AMMONIA CONCENTRATION AND DISCHARGE NORTH FORK SHENANDOAH RIVER NEAR STRASBURG, JULY 22-29, 2006



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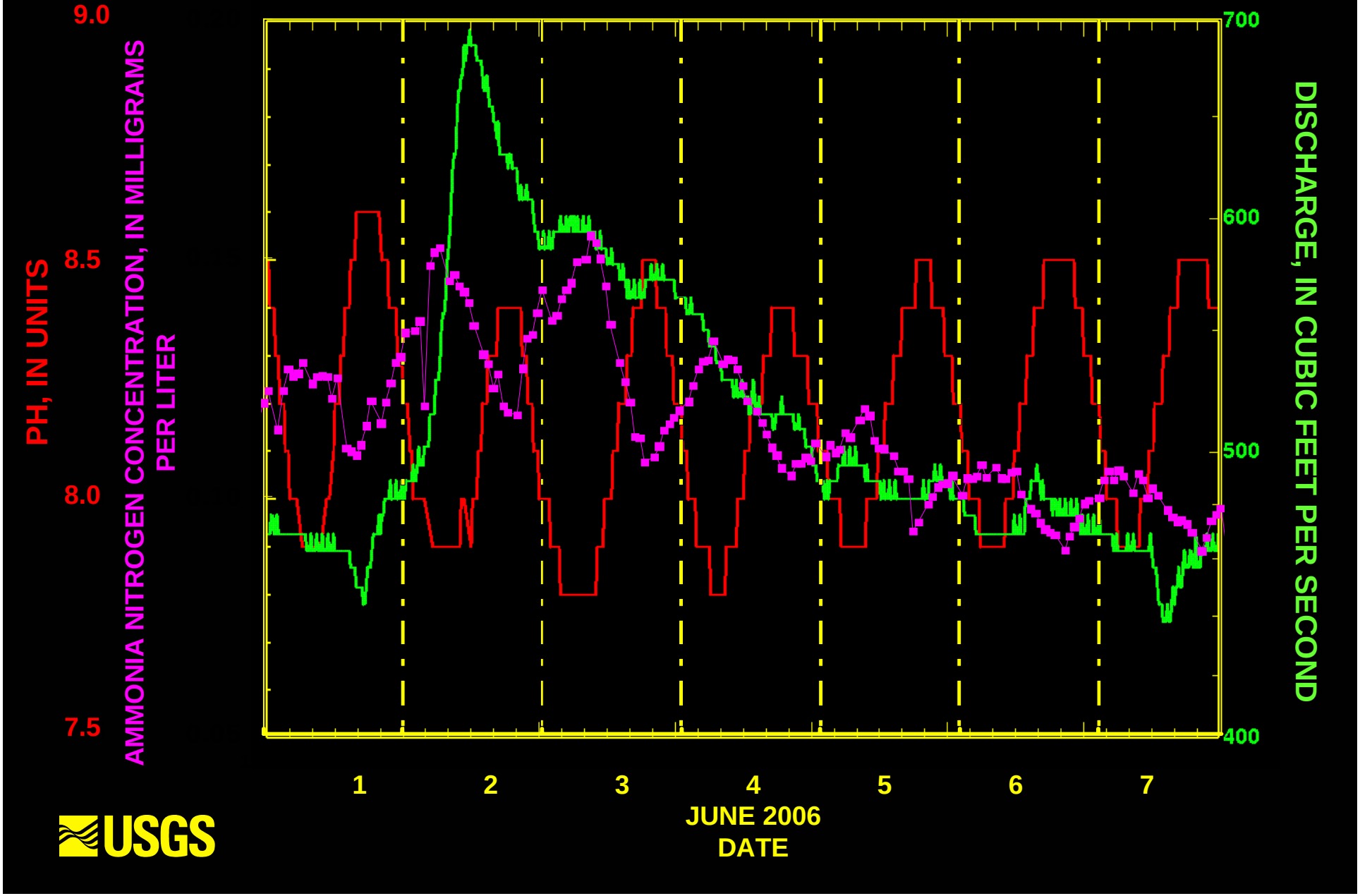
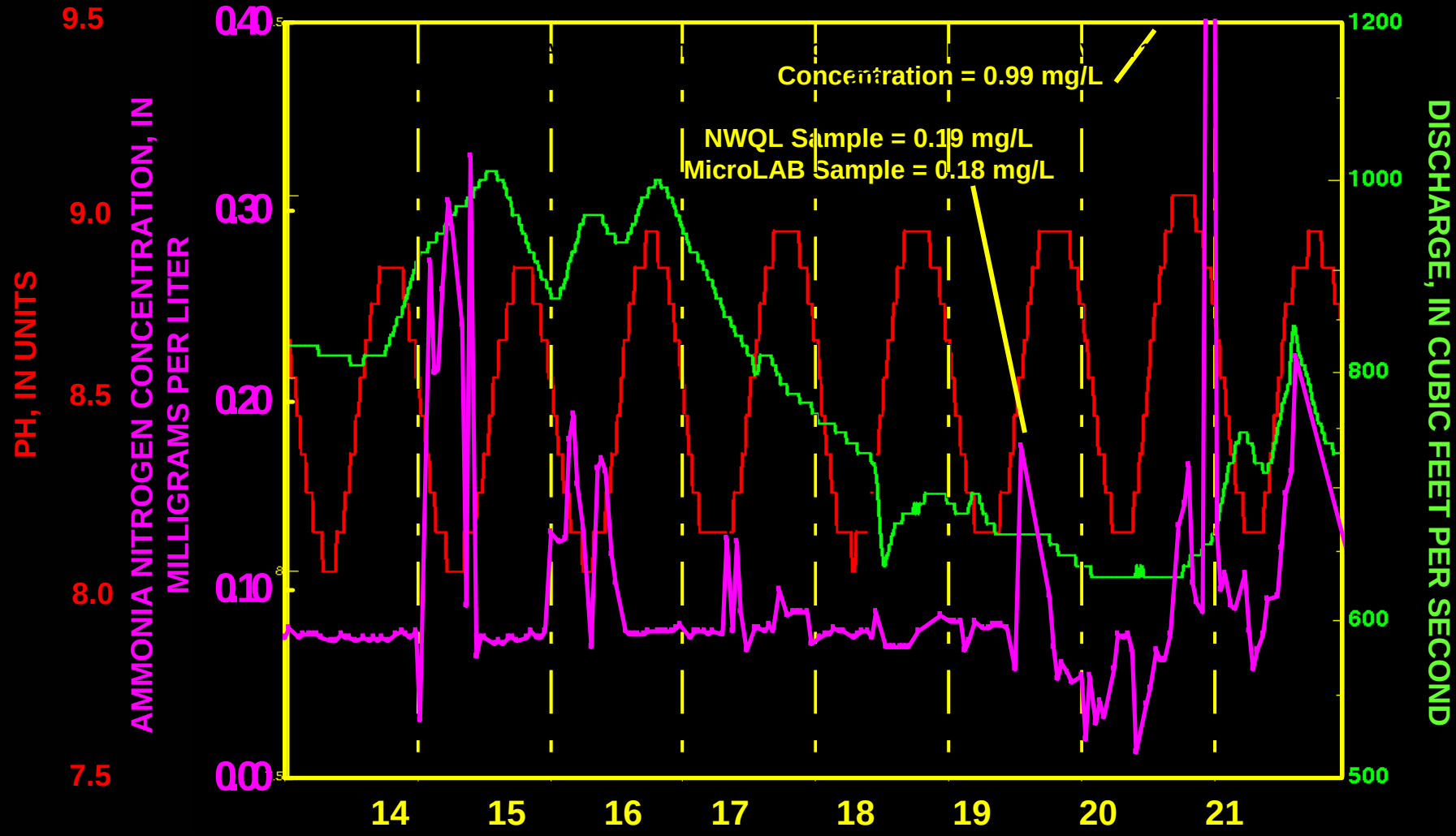
AMMONIA CONCENTRATION, PH, AND DISCHARGE, SOUTH FORK SHENANDOAH RIVER NEAR LURAY, JUNE 1-7, 2006



AMMONIA CONCENTRATION AND DISCHARGE, SOUTH FORK SHENANDOAH RIVER NEAR LURAY, JULY 14-21, 2006



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SUMMARY

- Ammonia concentrations increase and decrease during the initial increase in stream flow.
- Diurnal changes in pH and maximum values were greater in the early spring than in the late spring and summer and can be a factor affecting ammonia toxicity.
- PH decreases during increased stream flow.
- Ammonia concentrations can change diurnally during base flow.
- Some increases in streamflow appear to result from increased ground-water discharge and limited surface runoff.

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POSSIBLE IMPLICATIONS FOR AMMONIA TOXICITY

- Effect of large diurnal pH cycles cause large changes in un-ionized ammonia concentrations that might create “chronic” episodic stress.
- Large diurnal pH changes during base flow and decreases in pH during increased stream flow mean the potential for ammonia toxicity can be greater during base flow than storm flows.
- Ground-water discharge, point sources, and in-stream process can be a large part of ammonia sources.
- Continuous monitoring of the other nutrients could be critical to understanding ammonia dynamics and toxicity.

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