An evaluation of the sensitivity of freshwater mussels in 7-day effluent toxicity tests compared to commonly tested species

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Abstract

The federally endangered Tar River spinymussel (Elliptio Lanceolata) is endemic to the Tar River and Neuse River systems in North Carolina. An evaluation of the sensitivity of freshwater mussels in 7-day effluent toxicity tests compared to commonly tested species. The primary objective of this study was to (1) evaluate the sensitivity of non-endangered yellow lance (Elliptio lanceolata) and notched rainbow (Lampsis cariosa) and (2) compare the sensitivity of the effluent to the mussels (Tar River spinymussel, yellow lance, notched rainbow, yellow lampmussel, Lampsilis constricta, and Cercopagis dubia) as currently used to monitor the current range of the Tar River spinymussel. The results of this study indicate that the cladoceran and notched rainbow were more sensitive to ammonia compared to yellow lance, and two of these mussel species might become good surrogates for the Tar River spinymussel.

Introduction

The federally endangered Tar River spinymussel (Elliptio Lanceolata) is endemic to the Tar River and Neuse River systems in North Carolina. The species of spinymussel are endemic to the current range of the Tar River spinymussel. The primary objective of this study was to (1) evaluate the sensitivity of non-endangered yellow lance (Elliptio lanceolata) and notched rainbow (Lampsis cariosa) and (2) compare the sensitivity of the effluent to the mussels (Tar River spinymussel, yellow lance, notched rainbow, yellow lampmussel, Lampsilis constricta, and Cercopagis dubia) as currently used to monitor the current range of the Tar River spinymussel. The results of this study indicate that the cladoceran and notched rainbow were more sensitive to ammonia compared to yellow lance, and two of these mussel species might become good surrogates for the endangered Tar River spinymussel.

Objectives

• Evaluate the sensitivity of non-endangered yellow lance (Elliptio lanceolata) and notched rainbow (Lampsis cariosa) to 7 day effluent toxicity tests with the Tar River spinymussel to determine if these species could be used for the Tar River spinymussel

• Compare the sensitivity between theTar River spinymussel and commonly tested species (Cladocera, Cercopagis dubia, and fathead minnow)

• Acute sensitivity of the Tar River spinymussel to copper or ammonia in acute toxicity tests with copper or ammonia in acute toxicity tests with species which might be as an appropriate toxicity testing surrogate for the endangered Tar River spinymussel

Results: Effluent Toxicity

102010 testing of two effluents with four species

Control survival for the cladoceran, notched rainbow, and standard rainbow was 95% and 90% for the test effluent and control, respectively. However, yellow lance had only 52% control survival.

Effluent 1 was toxic to the cladoceran (reduced reproduction), but was not toxic to the Tar River spinymussel or the two mussels tested (notched rainbow and yellow lance; Fig. 1).

Effluent 2 was toxic to the two mussels tested (induced survival) and to the standard rainbow (reduced survival); however, cladocerans had no reduction in biomass (data not shown), but Tar River spinymussel was not toxic to the cladoceran (Fig. 1).

In Test 2, length of mussels was less sensitive endpoint compared to survival (data not shown).

Effluent 2 had induced amonnia concentration (Table 2), which was above USEPA acute water quality criterion of 1.28 mg/L at pH 7.9 and 27°C. This indicates that the high ammonia concentration may have contributed to the toxicity to fathead minnows and to the two mussels.

Results: Reference Toxicant

Conclusions

The results of the reference test indicate that the cladoceran and fathead minnow may not consistently represent mussel sensitivity to potential effluents.

References


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Future direction

As part of this project, a successful captive propagation program for the Tar River spinymussel is underway. When sufficient numbers are available for toxicity testing, the sensitivity of the Tar River spinymussel will be directly compared to potential surrogate mussel species in reference toxicity tests with copper and ammonia. These tests will determine which species is the most appropriate surrogate for the endangered Tar River spinymussel.

Future reference toxicity tests are also planned with endpoints of effluent exposure based on the chemical and potential concern in effluents near existing and historic locations for Tar River spinymussel.