Analysis of the Shell Length Distributions of Quagga Mussel (*Dreissena rostriformis bugensis*) taken from Lakes Mead and Mohave on the Colorado River Drainage during January-March 2007

by

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Analysis of Results from measurement of Lake Mead and Lake Mohave Quagga Mussel Sample Size Distributions

Five samples of specimens of *Dreissena rostriformis bugensis* were collected from hard surfaces in waters less than 2 m deep in Lake Mead (4 samples) and Lake Mohave (1 sample) on the Colorado River Drainage. The samples taken in Lake Mead were from the Las Vegas Boat Harbor on 1/16/07 (surface collected is unknown), Callville Bay on 01/26/07 and 03/16/07 from the submerged surfaces of houseboat pontoons, and Lake Mead Marina from submerged cement blocks and connecting cross bars. The Mohave Lake sample was taken 02/24/07 at Katherine Landing from submerged portions of houseboat hulls.

The shell lengths (SL, the greatest distance from the anterior tip of the umbos to the posterior edge of the shell) of all individuals in each sample were measured to the nearest 0.1 mm with digital calipers. The number of individuals in each 0.1 mm SL size class was then expressed as a percent of the total number of individuals in each sample allowing visualization of the size distribution of each sample (Fig. 1)

Shell lengths of quagga mussels ranged from 2.7 mm to 21.2 mm across all of the individuals in all five samples. In all five samples, there was a distinct size cohort representing individuals resulting from mussel reproduction and settlement in 2006. In Lake Mead at the Las Vegas Boat Harbor, this 2006 cohort ranged in SL from 2.1-13.4 mm, in Callville Bay Marina from 2.8-15.9 mm on 01/26/07 and from 3.8-19.5 mm on 02/24/04, and at the Lake Mead Marina from 5.3-19.2 mm. In Lake Mohave at Katherine Landing, the SL range of the 2006 cohort was 4.0-19.2 mm. Three of the samples also contained individuals large enough to appear to have resulted from reproduction and settlement in 2005. This 2005 cohort in Lake Mead included one individual with an SL of 17.5 mm in the Las Vegas Boat Harbor sample and five individuals ranging in SL from 19.5-20.8 mm from the Lake Mead Marina sample (Fig. 1). A 2005 cohort containing one individual with an SL of 21.2 mm was identified in the Katherine Landing sample from Lake Mohave (Fig. 1). No individuals large enough to form a 2005 cohort were found in either sample taken from Callville Bay Marina in Lake Mead (Fig. 1).

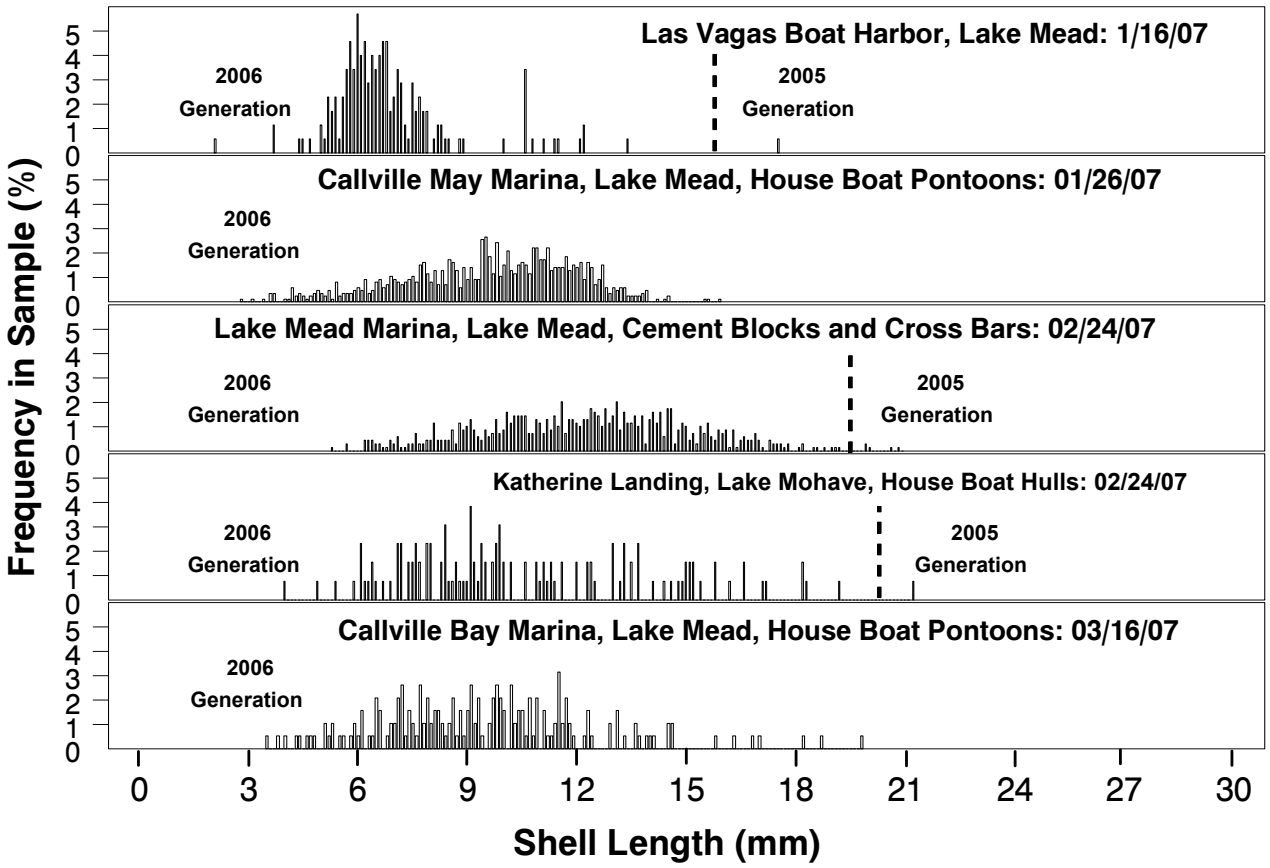

Fig. 1. Percent frequency distributions of individual shell lengths in five samples of guagga mussels (*Dreissena rostriformis bugensis*) collected from Lake Mead and Lake Mohave on the Colorado River drainage. The "2006 generation" indicates a mussel cohort settled in 2006 and the "2005 generation" indicates a mussel cohort settled in 2005. Size distributions of the 2006 and 2005 generations are separated by vertical dashed lines.

Preliminary Conclusions based on Quagga Mussel Shell Size Distributions in Lakes Mead and Mohave

Several preliminary conclusions can be drawn from the size distributions of the Lakes Mead and Mohave quagga mussel samples shown in Fig. 1. The lack of upward shift in the mean SL and shell size distributions of the 2006 cohort at Callville Bay Marina, which had a mean SL of 9.59 mm (SL range = 2.8-15.9 mm) in the sample taken on 01/26/07 and a mean SL of 9.46 mm (SL range = 3.8-19.5 mm) 29 days later on 02/24/04 suggested that individuals in the 2006 cohort in Lake Mead did not grow in size during the winter of 2006 when water temperatures were minimal. The appearance of a few large individuals of the 2005 cohort on shallow water substrata (i.e., boat hulls and cement blocks) in the Las Vegas Boat Harbor and Lake Mead Marina samples suggested that individuals in this cohort survived in the warm

surface waters of Lake Mead during the summer of 2006. The appearance of the 2005 cohort in the sample taken from a houseboat hull in Katherine Landing suggested that quagga mussels are also surviving through the summer in warm surface waters of Lake Mohave. Thus, it does not appear that warming of surface waters in either Lake will restrict quagga mussels to deeper, cooler regions of the lake. Development of shallow water populations of quagga mussels in both lakes will place near-surface water intakes at risk of mussel macrofouling along with deeper water intakes. It is also likely to impact marina operations and boats permanently moored in the lakes.

The presence of a few individuals of the 2005 cohort in Lakes Mead and Mohave suggested that the introduction of quagga mussels to Lake Mead occurred in at least 2004 or even 2003. The basis of this supposition is that a reproducing population of mussels must have existed somewhere in the Boulder Basin of Lake Mead in 2003 or 2004 in order to generate enough veliger larvae to settle as relatively wide-spread members of the 2005 cohort during the summer of 2005 and to be transported downstream as veligers from Lake Mead in the Colorado River to result in settlement of a 2005 cohort of mussels at Katherine Landing in lower reaches of Lake Mohave. Lack of members of this 2005 cohort at Callville Bay in the upper end of the Boulder Basin suggests that upstream veliger dispersal and settlement has been somewhat slower in the Boulder Basin of Lake Mead than downstream into Lake Mohave. However, discovery of mussels in the lower reaches of the Virgin Basin of Lake Mead suggests that upstream dispersal/transport of quagga mussels will continue to occur in Lake Mead unless means of preventing it are developed.

The very large ratios of individuals in the 2006 versus 2005 cohorts at 168:1 in Las Vegas Boat Harbor, 137:1 in the Lake Mead Marina and 129:1 in Katherine Landing suggested that the Lake Mead, Boulder Basin and Lake Mohave quagga mussel populations are in an explosive growth phase with densities of newly settled mussels (2007 cohort) produced during the 2007 reproductive season likely to be 1-2 orders of magnitude greater than those presently occurring in the Boulder Basin of Lake Mead and in Lake Mohave.