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Effect of sediment settling on controlling golden mussel invasion in water transfer project

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Inter-basin water transfer projects have been widely used to solve uneven distribution of water resources and water shortage in China. Along with the transferring of water resources, golden mussel (*Limnoperna fortunei*), the filter-collector macro-invertebrate species originating from southern China has also been inadvertently transferred to new aquatic environment, resulting in quick and uncontrolled spread of the species. The golden mussels are invasive by nature and endowed with a strong byssus for attaching onto their habitat, allowing them to easily invade natural and artificial aquatic systems, which was resulted in high-density golden mussel attachment that causes serious bio-fouling. Invasion and bio-fouling by golden mussels in water transfer systems has drawn attention widely because it has resulted in high resistance to water flow, corrosion of pipe walls and even clogging of tunnels, as well as causing water pollution and ecological imbalance in the regions that receive water infested with golden mussels.

Field investigation was conducted along the East River, which is the main drinking water resource for Cantong province and Hongkong, China, to study the natural habitats of golden mussels. Surveys of water transfer tunnels which carry water from the East River to several big cities in Cantong province were done to study golden mussel invasion and attachment in tunnels. It is found that in the natural habitat, golden mussels mainly attach to bedrock and bank stones and solid surfaces facing upstream, while no golden mussels are attached on the surfaces facing downstream and suffering sediment deposition. In the water transfer tunnels, golden mussel attachment densities of 40,000 individuals/m^2 mainly occurred on the portion of tunnel walls which face downwards and thus avoid sedimentation.

An experiment was designed to study the effect of sediment settling on golden mussel attachment. The results showed that settling of fine sediment particles affects golden mussels by preventing them from filtering food and oxygen from water, and in this way killing them. The attachment density decreased with increased sediment deposition. Golden mussel density decreased by about 70-90% when the sedimentation rate increased by 3-6 times. Therefore, spraying with fine sediment or creating hyper-concentration of sediment water to treat golden mussels before they enter tunnels is recommended as an effective strategy for controlling golden mussel invasion and high-density bio-fouling.

Key words: golden mussel invasion; bio-fouling; sediment settling; habitat; controlling strategy