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ABSTRACT

ELECTRICAL RESTORATION OF OYSTERS AND SALTMARSH AT A NEW YORK CITY ESTUARINE WETLAND

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Catastrophic loss of oyster reefs and saltmarshes has removed the major mechanisms of sediment and organic material filtration of estuarine waters, and of shore protection against erosion in the eastern United States and temperate coastal ecosystems worldwide. The Biorock low voltage solar-powered direct current electrical stimulation method has been used to restore oysters and saltmarsh in a severely polluted New York City estuarine wetland, next to a former navy shipyard and toxic waste dump. Oysters (*Crassostrea virginica*) receiving low amounts of electrical current increased in length 5.82 times faster than controls, and oysters receiving higher amounts of current grew 9.30 times faster than controls over the 2011 summer growing season. Control oysters decreased in size from by 4 mm over Winter 2010-2011 and had chalky dissolved shells, while low electrical current oysters had no change in size, and medium and high current oysters grew by 6 mm and 8 mm respectively, and had shiny shells. Control oysters had more than 91% over-winter mortality in this severely polluted habitat, while mortality of oysters under low, medium, and high electrical currents were 34%, 31% and 0% respectively. Saltmarsh grass (*Spartina alterniflora*) controls grew by 5 cm/week, while those receiving low electrical current grew by 9 cm/week and those receiving higher current grew by 11 cm/week. *Spartina* planted in a seep draining the toxic waste dump, at a site lower in the intertidal than the lowest tolerance limit of *Spartina,* had 100% mortality in two successive winters, while *Spartina* under electrical stimulation had two thirds survival over three winters and sent up new shoots each following spring. Electrified *Spartina* showed much higher growth rates in the summer, greener leaves, more stems per clump, more abundant, thicker, and darker roots. Our results demonstrate that the Biorock method is able to keep oysters and saltmarsh alive and growing under conditions that would otherwise be toxic. The much greater growth and survival even under the most severe water quality conditions therefore make the Biorock method ideally suited to restoring oyster reefs and saltmarshes where all other methods fail, and of greatly increasing oyster mariculture productivity. Biorock methods are even able to extend seaward saltmarshes that are now eroding from global sea level rise and pollution.