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Advancing Eastern Oyster Aquaculture through Marker-Assisted Selection R/6410-0010

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Dr. Ximing Guo and colleague Paola López-Duarte challenge oysters with *Perkinsus marinus* (a pathogen that causes Dermo disease) in the lab.

The eastern oyster (*Crassostrea virginica* Gmelin) is one of the most important marine resources in the US. Over the past 60+ years, however, over-fishing, habitat destruction and diseases have decimated eastern oyster populations and fisheries in much of the mid-Atlantic region including Delaware Bay. The prolonged decline in oyster fishery has brought social and economic hardship to coastal areas. Oyster farming or aquaculture has the potential to ease the economic pain of coastal communities by providing stable jobs and high quality oysters without adding additional fishing pressure to wild stocks.

Oyster aquaculture in New Jersey and much of the Atlantic U.S. faces many challenges. The lack of a domesticated stock with desirable traits for aquaculture is a major impediment. The eastern oyster faces two major diseases: MSX (caused by the parasite *Haplosporidium nelsoni*) and Dermo (caused by the parasite *Perkinsus marinus*). These diseases present a major threat to oyster aquaculture, as each of them can cause up to 90% mortality in susceptible stocks.

Rutgers University has been breeding oysters since the early 1960s. Strains resulting from the Rutgers breeding program have shown strong resistance to MSX. However, the Rutgers strain has only moderate resistance to Dermo. Further improvement in Dermo-resistance has been slow. Currently, selection is based on field-exposure, which becomes ineffective in years when disease exposure is low or absent. The inability to maintain constant selection pressure presents a major challenge for breeding disease-resistance in oysters. The problem can be solved by identifying genetic markers for disease-resistance and practicing marker-assisted selection. With disease-resistance markers, we can target them in years when diseases are absent. Even when diseases are present, disease-resistance markers can be used to increase selection pressure and efficiency by selecting the best genotypes among survivors.

Dr. Guo's team at Rutgers University has been actively working on the identification of disease-resistance genes in oysters. Through several years of research on the oyster genome, they have identified a few disease-resistant markers that are ready to be tested for marker-assisted selection in the field. In this new project Dr. Guo's team will test the efficacy of marker-assisted selection for disease-resistance. They will select the most disease-resistant oysters based on their field survival as well as their genetic makeup. The addition of marker-assisted selection is expected to improve selection efficiency and speed up the development of disease-resistant oysters. These improved disease-resistant oysters should give oyster farmers a much better return. They may also speed up the recovery of wild oyster populations in Delaware Bay and beyond.

Oyster spawn.