CLAIMS

What is claimed is:

1. Use of a genetically modified donor bacteria configured to express a heterologous molecule in the manufacture of a medicament for the treatment of Early Mortality Syndrome (EMS) in an organism comprising :

- a genetically modified donor bacteria configured to express one or more of the following:
  - a heterologous anti-sense RNA (asRNA) polynucleotide that is complementary to the mRNA of an essential gene of an EMS-causing bacterial pathogen; or
  - a first heterologous quorum quenching molecule configured to inhibit one or more exogenous autoinducer-1 (AI-1) molecules; or
  - a second heterologous quorum quenching molecule configured to remove exogenous autoinducer-2 (AI-2) molecules from the environment and transport them into said genetically modified donor bacteria; and
- introducing said genetically modified donor bacteria to a target host that is infected by, or susceptible to infection by said EMS-causing bacterial pathogen.

2. Use of the genetically modified donor bacteria of claim 1 wherein said target host is an aquatic organism.

3. Use of the genetically modified donor bacteria of claim 2 wherein said aquatic organism is a shrimp.

4. Use of the genetically modified donor bacteria of claim 3 wherein said shrimp comprise shrimp raised in aquaculture.

5. Use of the genetically modified donor bacteria of claim 1 wherein said EMS-causing bacterial pathogen comprises a species of *Vibrio*.

6. Use of the genetically modified donor bacteria of claim 1 wherein said essential gene of said EMS-causing bacterial pathogen comprises a DNA adenine methylase (*dam*) gene.

7. Use of the genetically modified donor bacteria of claim 6 wherein said *dam* gene comprises a nucleotide sequence according to SEQ ID NO. 4, or a sequence having approximately 75% or more homology with SEQ ID NO. 4.

8. Use of the genetically modified donor bacteria of claim 1 wherein said heterologous asRNA polynucleotide comprises a heterologous asRNA polynucleotide configured to inhibit expression of a DNA adenine methylase (*dam*) gene, or a homolog thereof.

9. Use of the genetically modified donor bacteria of claim 8 wherein said heterologous asRNA polynucleotide configured to inhibit expression of a DNA adenine methylase (*dam*) gene comprises a heterologous asRNA polynucleotide according to SEQ ID NO. 3, or a sequence having approximately 85% or more homology with SEQ ID NO. 3.

10. Use of the genetically modified donor bacteria of claim 1 wherein said second heterologous quorum quenching molecule configured to remove exogenous AI-2 molecules from the environment and transport them into said genetically modified donor bacteria is encoded by an *lsr* operon operably linked to a promotor that is configured to express at least one ATP-binding cassette transporter (ABC transporter) and at least one chaperone protein that actively pump exogenous autoinducer molecule AI-2 from the environment into said genetically modified donor bacteria .

11. Use of the genetically modified donor bacteria of claim 10 wherein said *lsr* operon comprises the nucleotide sequence according to SEQ ID NO. 2, or a sequence having approximately 75% or more homology with SEQ ID NO. 2.

12. Use of the genetically modified donor bacteria of claim 1 wherein said first heterologous quorum quenching molecule configured to inhibit one or more exogenous AI-1 molecules comprises a homoserine lactonases (AHL lactonase) configured to inactivate exogenous AI-1 molecules.

13. Use of the genetically modified donor bacteria of claim 12 wherein said AHL lactonase configured to inactivate exogenous AI-1 molecules comprises an AHL lactonase configured to inactivate exogenous AHL class QS molecules.

14. Use of the genetically modified donor bacteria of claim 13 wherein said exogenous AHL class QS molecules comprise exogenous Hal-1 molecules.

15. Use of the genetically modified donor bacteria of claim 12 wherein said AHL lactonase configured to inactivate exogenous AI-1 molecules comprises a heterologous *aidH* gene.

16. Use of the genetically modified donor bacteria of claim 15 wherein said heterologous *aidH* gene comprises a nucleotide sequence according to SEQ ID NO. 1, or a sequence having approximately 75% or more homology with SEQ ID NO. 1.

17. Use of the genetically modified donor bacteria of claim 1 wherein said genetically modified donor bacteria comprises a genetically modified donor microorganism selected from the group consisting of: a symbiotic genetically modified donor bacteria, a shrimp probiotic genetically modified donor bacteria, an shrimp symbiotic genetically modified donor bacteria an shrimp endosymbiotic genetically modified donor bacteria, an shrimp enteric genetically modified donor bacteria, Ag1, *Salmonella typhimurium, Bacillus subtilis, Enterobacter, E. coli*, a genetically modified donor algae, or other symbiotic bacteria.

18. Use of the genetically modified donor bacteria of claim 1 and further comprising providing a therapeutically effective amount of said genetically modified donor bacteria to a target host wherein the therapeutically effective amount results in a reduction in mortality due to EMS caused by one or more EMS-causing *Vibrio*.

19. Use of the genetically modified donor bacteria of claim 1 and further comprising providing a therapeutically effective amount of said genetically modified donor bacteria to a target host wherein the therapeutically effective amount results in a reduction in biofilms or expression of pathogenesis genes including those involved in toxin production caused by one or more EMS-causing *Vibrio*.

20. Use of the genetically modified donor bacteria of claim 1 and further comprising providing a therapeutically effective amount of said genetically modified donor bacteria to a target host wherein

the therapeutically effective amount results in a reduction in pathogenicity of one or more EMS-causing *Vibrio*.