Claims:

1. A composition for deployment into a marine oil spill, the composition consisting of:

a plurality of enriched hydrocarbon-degrading microbiome aggregates suspended in a liquid medium, wherein an enriched hydrocarbon-degrading microbiome is agglomerated by biofilms onto a carrier selected from crustacean carcasses, crustacean eggs, crustacean larvae, crustacean juveniles, crustacean fecal matter, crustacean shells, particulate exoskeletons of marine molluscs, particulate shells of marine molluscs, particulate microalgae, particulate macroalgae, clays, zeolites, copepod carcasses, copepod eggs, copepod larvae, copepod juveniles, copepod fecal matter, krill carcasses, krill eggs, krill larvae, krill juveniles, krill fecal matter, and combinations thereof, to thereby form the plurality of enriched hydrocarbon-degrading microbiome aggregates; and

one or more of a C_{5-40} hydrocarbon, a surfactant, an emulsifier, an enzyme, a dispersant, and combinations thereof;

whereby the composition is a dynamic microbiome composition wherein numbers of individual hydrocarbon-degrading microbial species are increasing and/or decreasing.

2. The composition according to claim 1, wherein the C_{5-40} hydrocarbon is selected from one or more of a crude oil, a marine fuel, a bunker fuel, a diesel fuel, kerosene, a xylene, a benzene, a toluene, a naphthalene, and combinations thereof.

3. The composition according to claim 1 or 2, wherein the liquid medium is selected from one of Bushnell Haas nutrient broth, Väätänen Nine-Salt Solution (VNSS), marine broth, Luria-Bertani marine broth, 2% NaCl Mueller-Hinton broth, and Zobell marine broth.

4. The composition according to any one of claims 1 to 3, wherein the plurality of enriched hydrocarbon-degrading microbiome aggregates consist one or more of *Acanthopleuribacter* spp., *Acinetobactor* spp., *Alcanivorax* spp., *Alteromonadaceae* spp., *Cycloclasticus* spp., *Flavobacterium* spp., *Hyphomonas* spp., *Marinobacter* spp., *Porticoccaeae* spp., *Pseudomonas* spp., *Rhodobacteraceae s*pp., *Sphingopyxis* spp., *Sphingobium* spp., and *Xanthobacter* spp.

5. The composition according to any one of claims 1 to 4, wherein the liquid medium is a volume of a marine water.

6. Use of the composition according to any one of claims 1 to 5, to degrade and ameliorate a marine oil spill.

7. A method for producing a composition for deployment into marine oil spills, comprising:

collecting a seawater sample from a selected marine water column that has been subjected to prior marine oil spills and/or is chronically contaminated with hydrocarbons;

culturing the seawater sample in a first liquid medium supplemented with one or more $C_{5\text{-}40}$ hydrocarbons selected from crude oils, marine fuels, bunker fuels, diesel fuels, kerosenes, xylenes, benzenes, toluenes, and naphthalene, to thereby select and enrich a hydrocarbon-degrading microbiome therein;

mixing the selected hydrocarbon-degrading microbiome in the first liquid medium for at least 7 days at a RPM (revolutions per minute) selected from a range of 0.5 RPM to 30 RPM to thereby form the plurality of enriched hydrocarbon-degrading microbiome aggregates wherein each of the plurality of enriched hydrocarbon-degrading microbiome aggregates comprises microbiome-produced biofilms extending therethrough and thereabout;

transferring a portion of the plurality of enriched hydrocarbon-degrading microbiome aggregates into a second liquid medium containing therein a selected carrier; and

culturing the transferred portion of enriched hydrocarbon-degrading microbiome aggregates by mixing at a RPM selected from a range of 0.5 RPM to 30 RPM for at least 24h, to thereby form the composition.

8. The method according to claim 7, wherein the sea water sample is cultured in the first liquid medium at a temperature from one of a range of 1 °C to 10 °C, a range of 10 °C to 20 °C, and a range of 15 °C to 25 °C.

9. The method according to claim 7 or 8, wherein the second liquid medium is a marine water sample additionally comprising a C_{5-40} hydrocarbon selected from crude oils, marine fuels, bunker fuels, diesel fuels, kerosenes, xylenes, benzenes, toluenes, and naphthalene.

10. The method according to any one of claims 7 to 9, wherein the plurality of enriched hydrocarbon-degrading microbiome aggregates comprises one or more of *Acanthopleuribacter* spp., *Acinetobactor* spp., *Alcanivorax* spp., *Alteromonadaceae* spp., *Cycloclasticus* spp., *Flavobacterium* spp., *Hyphomonas* spp., *Marinobacter* spp., *Porticoccaeae* spp., *Pseudomonas* spp., *Rhodobacteraceae s*pp., *Sphingopyxis* spp., *Sphingobium* spp., *Xanthobacter* spp.

11. The method according to any one of claims 7 to 10, wherein the carrier is selected from one of crustacean carcasses, crustacean eggs, crustacean larvae, crustacean juveniles, crustacean fecal matter, crustacean shells, particulate exoskeletons of marine molluscs, particulate shells of marine molluscs, particulate microalgae, particulate macroalgae, clays, zeolites, copepod carcasses, copepod eggs, copepod larvae, copepod juveniles, copepod fecal matter, krill

carcasses, krill eggs, krill larvae, krill juveniles, krill fecal matter, and combinations thereof.

12. A method for producing hydrocarbon-enriched microbiome aggregate components for use in formulating a dynamic microbiome-based compositions for deployment into marine oil spills, comprising:

collecting a seawater sample from a selected marine water column that has been subjected to prior marine oil spills and/or is chronically contaminated with hydrocarbons;

culturing a first portion of the seawater sample in a first liquid medium supplemented with a first selected C_{5-40} hydrocarbon from one of a crude oil, a marine fuel, a bunker fuel, a diesel fuel, kerosene, a xylene, a benzene, a toluene, and naphthalene, to thereby select and enrich a first hydrocarbon-degrading microbiome therein, said first enriched hydrocarbon-degrading microbiome comprises one or more of *Acanthopleuribacter* spp., *Acinetobactor* spp., *Alcanivorax* spp., *Alteromonadaceae* spp., *Cycloclasticus* spp., *Flavobacterium* spp., *Hyphomonas* spp., *Marinobacter* spp., *Porticoccaeae* spp., *Pseudomonas* spp., *Rhodobacteraceae s*pp., *Sphingopyxis* spp., *Sphingobium* spp., *Xanthobacter* spp.;

mixing the first enriched hydrocarbon-degrading microbiome in the first liquid medium for at least 7 days at a RPM selected from a range of 0.5 RPM to 30 RPM to thereby form the plurality of first enriched hydrocarbon-degrading microbiome aggregates wherein each of the plurality of first enriched hydrocarbon-degrading microbiome aggregates comprises first microbiome-produced biofilms extending therethrough and thereabout; and

maintaining the plurality of first enriched hydrocarbon-degrading microbiome aggregates in a viable condition by repeated transfers of the plurality of first enriched hydrocarbon-degrading microbiome aggregates every 7 days into a fresh first selected liquid medium for a continued gentle mixing a RPM selected from a range of 0.5 RPM to 30 RPM.

13. The method according to claim 12, additionally comprising:

culturing a second portion of the seawater sample in a second liquid medium supplemented with a second selected C_{5-40} hydrocarbon from one of a crude oil, a marine fuel, a bunker fuel, a diesel fuel, kerosene, a xylene, a benzene, a toluene, and naphthalene for at least 7 days, to thereby select and enrich a second hydrocarbon-degrading microbiome therein, said second enriched hydrocarbon-degrading microbiome comprises one or more of *Acanthopleuribacter* spp., *Acinetobactor* spp., *Alcanivorax* spp., *Alteromonadaceae* spp., *Cycloclasticus* spp., *Flavobacterium* spp., *Hyphomonas* spp., *Marinobacter* spp., *Porticoccaeae* spp., *Pseudomonas* spp., *Rhodobacteraceae* spp., *Sphingopyxis* spp., *Sphingobium* spp., *Xanthobacter* spp.;

mixing the second enriched hydrocarbon-degrading microbiome in the second liquid medium for at least 7 days at a RPM selected from a range of 0.5 RPM to 30 RPM to thereby form the plurality of second enriched hydrocarbon-degrading microbiome aggregates wherein each of the plurality of second enriched hydrocarbon-degrading microbiome aggregates comprises second microbiome-produced biofilms extending therethrough and thereabout; and

maintaining the plurality of second enriched hydrocarbon-degrading microbiome aggregates in a viable condition by repeated transfers of the plurality of second enriched hydrocarbon-degrading microbiome aggregates every 7 days into a fresh second selected liquid medium for a continued gentle mixing a RPM selected from a range of 0.5 RPM to 30 RPM.

14. The method according to claim 13, additionally comprising:

culturing a third portion of the seawater sample in a third liquid medium supplemented with a third selected C_{5-40} hydrocarbon from one or more of a crude oil, a marine fuel, a bunker fuel, a diesel fuel, kerosene, a xylene, a benzene, a toluene, and a naphthalene at a

temperature selected from a range of 1 °C to 25 °C for at least 7 days, to thereby select and enrich a third hydrocarbon-degrading microbiome therein, said third enriched hydrocarbon-degrading microbiome comprises one or more of *Acanthopleuribacter* spp., *Acinetobactor* spp., *Alcanivorax* spp., *Alteromonadaceae* spp., *Cycloclasticus* spp., *Flavobacterium* spp., *Hyphomonas* spp., *Marinobacter* spp., *Porticoccaeae* spp., *Pseudomonas* spp., *Rhodobacteraceae s*pp., *Sphingopyxis* spp., *Sphingobium* spp., *Xanthobacter* spp.;

mixing the third enriched hydrocarbon-degrading microbiome in the third liquid medium for at least 7 days at a RPM selected from a range of 0.5 RPM to 30 RPM to thereby form the plurality of third enriched hydrocarbon-degrading microbiome aggregates wherein each of the plurality of third enriched hydrocarbon-degrading microbiome aggregates comprises third microbiome-produced biofilms extending therethrough and thereabout; and

maintaining the plurality of third enriched hydrocarbon-degrading microbiome aggregates in a viable condition by repeated transfers of the plurality of third enriched hydrocarbon-degrading microbiome aggregates every 7 days into a fresh third selected liquid medium for a continued gentle mixing a RPM selected from a range of 0.5 RPM to 30 RPM.

15. The method according to claim 14, additionally comprising:

culturing a fourth portion of the seawater sample in a fourth liquid medium supplemented with a fourth selected C_{5-40} hydrocarbon selected from crude oils, marine fuels, bunker fuels, diesel fuels, kerosenes, xylenes, benzenes, toluenes, and naphthalene, for at least 7 days to thereby select and enrich a fourth hydrocarbon-degrading microbiome therein;

mixing the fourth enriched hydrocarbon-degrading microbiome in the third liquid medium for at least 7 days at a RPM selected from a range of 0.5 RPM to 30 RPM to thereby form the plurality of fourth

enriched hydrocarbon-degrading microbiome aggregates wherein each of the plurality of fourth enriched hydrocarbon-degrading microbiome aggregates comprises fourth microbiome-produced biofilms extending therethrough and thereabout; and

maintaining the plurality of fourth enriched hydrocarbon-degrading microbiome aggregates in a viable condition by repeated transfers of the plurality of fourth enriched hydrocarbon-degrading microbiome aggregates every 7 days into a fresh fourth selected liquid medium for a continued gentle mixing a RPM selected from a range of 0.5 RPM to 30 RPM.

16. The method according to claim 15, wherein the fourth enriched hydrocarbon-degrading microbiome is recultured, mixed again, and maintained again, one or more times.

17. The method of producing a composition for deployment into a marine oil spill, comprising:

combining a plurality of the first enriched hydrocarbon-degrading microbiome aggregates produced according to the method of claim 13 with one or more of a plurality of the second enriched hydrocarbon-degrading microbiome aggregates produced according to the method of claim 14, a plurality of the third enriched hydrocarbon-degrading microbiome aggregates produced according to the method of claim 15, and a plurality of the fourth enriched hydrocarbon-degrading microbiome aggregates produced according to the method of claim 16,

transferring the combined pluralities of enriched hydrocarbon-degrading microbiome aggregates into a liquid medium comprising:

a carbon-starved minimal medium;

a carrier selected from crustacean carcasses, crustacean eggs, crustacean larvae, crustacean juveniles, crustacean fecal matter, crustacean shells, particulate exoskeletons of marine molluscs, particulate shells of marine molluscs,

particulate microalgae, particulate macroalgae, clays, zeolites, copepod carcasses, copepod eggs, copepod larvae, copepod juveniles, copepod fecal matter, krill carcasses, krill eggs, krill larvae, krill juveniles, krill fecal matter, and combinations thereof;

a C_{5-40} hydrocarbon selected from one of a crude oil, a marine fuel, a bunker fuel, a diesel fuel, kerosene, a xylene, a benzene, a toluene, and naphthalene;

mixing the combined pluralities of the enriched hydrocarbon-degrading microbiome aggregates, at a temperature selected from one of 1 °C to 10 °C, 10 °C to 20 °C, and 15 °C to 25 °C, in a RPM selected from a range of 0.5 RPM to 30 RPM for at least 24 h to thereby produce the tailored dynamic microbiome-based composition.

18. The method according to claim 17, wherein one or more of a surfactant, an emulsifier, an enzyme, a dispersant, and combinations thereof, is added into the composition.