flavour compounds are then absorbed by the fish being grown. Overtime, the off-flavour compounds accumulate in the flesh of the fish, causing the product to have an unpleasant taste and/or odour.

[0005] Typical approaches to addressing off-flavour compounds include replacing the circulating water with new water, cleaning one or more tanks and conduits to reduce or remove the biofilm, and additionally, moving the fish to a new tank or RAS and placing them on a restricted diet in order to allow the off-flavour compound to be cleared from their bodies. This clearance, or depuration procedure can take days or weeks and may put further economic stress on the operator of the RAS and the altered diet may ultimately impact the market price of the fish due to changes in mass and texture of the fish, as well as increasing the water-use footprint of the operation. Other, typically less effective, approaches for dealing with off-flavour compounds include employing further filters, oxidizing agents and ultraviolet light.

[0006] A further challenge that off-flavour compounds pose in RAS is that they are difficult to detect until, at least sometimes, analysis of the fish already indicates an off-flavour or odour.

SUMMARY

[0007] The examples of the present disclosure generally relate to compositions, systems, and methods for processing water of a recirculating aquaculture system (RAS). In particular, the compositions, systems, and methods disclosed herein pertain to removal from RAS water, of one or more target compounds, such as organic compounds like terpenoids and other compounds known to cause undesirable flavors of RAS farmed fish and/or shellfish. Such off-flavours typically render the farmed product permanently or temporarily unmarketable and the known methods for mitigating the impact of the off-flavour compounds can also negatively impact the farmed product. Additionally, the compositions, systems, and methods disclosed herein relate to removal of one or

more steroid compounds, such as corticosteroids, from RAS water. Such steroid compounds are known to disrupt animal health and growth, which in turn can interfere with RAS operations.

[0008] Some examples of the present disclosure relate to compositions, methods and apparatus for reducing and/or removing of one or more target compounds from RAS water including, but are not limited to a terpene, a terpenoid, an amine-based compound, a haloanisole, a steroid such as a corticosteroid like cortisol, or combinations thereof. Further specific, but non-limiting examples of a target compound include: geosmin and 2-methylisoborneol (2-MIB). Target compounds may also include steroid compounds like the corticosteroid cortisol. Some examples of the present disclosure relate to compositions, methods and apparatus for reducing and/or removing two or more target compounds from RAS water.

[0009] According to some examples of the present disclosure, the compositions disclosed herein may comprise one or more enriched microbiome-based components and an optional biofilm that is configured to coalesce at least a portion of the enriched microbiome-based components for loading on to a carrier and/or for mixing with an additive.

[0010] According to some examples of the present disclosure, one or more selected microbiome components may be isolated from water that has been exposed to one or more target, off-flavour compounds, then enriched by methods disclosed herein, and maintained in fluid media supplemented with one or more target, off-flavour compounds. In some examples of the present disclosure, the enriched microbiome components may be combined with a selected carrier or additive, optionally by the presence of the biofilm, then deployed within a recirculating aquaculture system (RAS). The selected microbiome components may comprise complex naturally occurring mixtures of biological species collected from selected RAS, or elsewhere, and they may be further selected for their ability to consume (or otherwise chemically alter) one or more target, off-flavour

compounds as energy and/or nutrient sources. According to some examples of the present disclosure, the selected microbiome components may be enriched with one or more target compounds, such as geosmin and/or 2-MIB and/or cortisol. Selecting the microbiome components may result in an increased abundance of the biological species that consume one or more target compounds relative to other biological species within the selected microbiome components that do not consume one or more target compounds. The increased abundance may be due to an increased amount of the consuming species, a decrease in the amount of the non-consuming or producing species or a combination thereof.

[0010a] In one aspect, the present disclosure refers to a composition for deploying into water of a recirculating aquaculture system (RAS), the composition comprising: (a) an enriched microbiome that is configured to reduce an amount of a target compound by a desired amount within the water; and (b) a carrier that is configured to induce the enriched microbiome to produce a biofilm or to sequester at least a portion of the target compound from the water or both.

[0010b] In another aspect, the present disclosure refers to a method for preparing a microbiome-based composition for deploying into water of a RAS, the method comprising: (a) selecting a microbiome sample from a water source that has been exposed to a target compound; (b) preparing an inoculum from the microbiome sample; (c) enriching the inoculum to produce a microbial consortium that degrades, consumes or otherwise converts one or more target compounds in the inoculum by culturing the inoculum in a medium that contains the one or more target compounds to produce an enriched microbial consortium; (d) culturing the enriched microbial consortium in a suitable nutrient medium for producing greater quantities of the enriched microbial consortium.

[0010c] In another aspect, the present disclosure refers to a method for preparing a microbiome-based composition for deploying into water of a RAS, the method comprising: (a) selecting a microbiome sample from a water source that has been exposed to an unrelated metabolic target compound, wherein metabolizing of the unrelated metabolic target compound results in degradation of a target compound; (b) preparing an inoculum from the microbiome sample; (c) enriching the inoculum to produce an enriched microbial consortium that degrades, consumes or otherwise converts one or more target, off-flavour compounds in the inoculum by culturing the inoculum in a medium that contains the one or more target, off-flavour compounds, the unrelated metabolic target compound or both to produce an enriched microbial consortium; (d) culturing the enriched microbial consortium in a suitable nutrient medium for producing greater quantities of microbial consortium.

[0010d] In another aspect, the present disclosure refers to a filter for use with a recirculating aquaculture system, the filter comprising: (a) a surface; (b) a microbiome aggregate adhered to the surface, wherein the microbiome aggregate comprises an enriched microbial consortium in a suitable nutrient medium for producing greater quantities of microbial consortium; and (c) a biofilm and wherein the enriched microbial consortium is configured to reduce an amount of a target compound within water that passes along the surface.

[0010e] In another aspect, the present disclosure refers to a recirculating aquaculture system (RAS) comprising: (a) a holding tank for holding a body of water; (b) a waste removal system that is configured to reduce one or both of chemical waste or solid waste within the body of water; (c) one or more conduits for fluidly connecting the holding tank and the waste removal system; (d) a pumping system for circulating water through the one or more conduits; and (e) a microbiome aggregate that comprises an enriched microbial consortium adhered to a surface of a carrier by a biofilm and wherein the enriched microbial consortium is configured to reduce an amount of a target compound within body of water.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] These and other features of the present disclosure will become more apparent in the following detailed description in which reference is made to the appended drawings. The appended drawings illustrate one or more embodiments of the present disclosure by way of example only and are not to be construed as limiting the scope of the present disclosure.

[0012] FIG. 1 is a schematic illustration of a process according to an embodiment of the present disclosure, for the capture and enrichment of geosmin and/or 2-methylisoborneol and/or cortisol-degrading microbiomes from recirculating aquaculture systems (RAS), for use in one or more of aquaculture feed formulations and RAS processing equipment.

[0013] FIG. 2 is a schematic illustration of a system according to an embodiment of the present disclosure, for monitoring, assessing, and modulating recirculating water and the inherent microbial populations in RAS, by controlled selective inputting of selected enriched microbiomes produced by some of the methods disclosed herein.

[0014] FIG. 3 is a schematic illustration of a process to collect RAS microbiome samples from recirculating aquaculture water, to select, to enrich geosmin-degrading microbial species in the RAS microbiome samples, to