CLAIMS

Claim 1. A system for rearing invertebrates, the system comprising a climate chamber (2) and a plurality of crates (4) arranged into at least two stacks (6), each crate in a stack defining an airflow path (80) there through from an inlet opening (48) in a first wall (46) to an outlet opening (48) in a second wall (46) opposite the first wall, characterised in that said climate chamber comprises:

an internal volume enclosed by walls, a floor, and a ceiling;

a first row of air outlets (20) extending in a first direction within the internal volume;

a second row of air outlets (20) extending parallel to the first row of air outlets within the internal volume;

a row of air inlets (18) located between the first and second rows of air outlets, and extending parallel thereto, and spaced apart from the first and second rows of air outlets in a second direction, perpendicular to the first direction;

at least one first stack (6) of crates (4) arranged in a space between the first row of air outlets and the row of air inlets;

at least one second stack (6) of crates (4) arranged in a space between the second row of air outlets (20) and the row of air inlets (18);

a conduit (38) extending from each of the plurality of air inlets between the first and second stack of crates, said conduit comprising a plurality of conduit openings (40) configured to align with inlet openings (48) of the plurality of crates (4) in each stack (6);

wherein the crates (4) are arranged with the airflow path (80) oriented perpendicular to the first direction;

wherein the climate chamber further comprises at least ~~one~~ two track(s) (10) extending in the first direction with the climate chamber, ~~said~~ wherein each track of at least two tracks (10) comprises~~ing~~ a first wall (12) and a second wall (12), and a channel (14) defined there between;~~.~~ and

whereby each of the at least one stack~~s~~ (6) of crates (4) and the at least one second stack (6) of crates (4), optionally positioned on a pallet, rest(s) on a corresponding of the at least two track(s) (10).

~~2. The system according to claim 1, wherein the track (10) is positioned between the first row of air outlets (20) and the row of air inlets (18), and wherein the system, preferably, comprises a second track (10) positioned between the row of air inlets (18) and the second row of air outlets (20).~~

~~3. The system according to claim 1 or claim 2, wherein the at least one track (10) comprises a pair of walls (12) separated from each other by a channel, said channel extending in the second direction, which is perpendicular to the first direction; and~~

~~optionally, wherein the at least one stack (6) of crates (4) is arranged on the tracks (10) such that the airflow path (80) extends in the first direction.~~

Claim 24. The system according to claim 1~~, 2 or 3~~, wherein each track (10) is configured to support a row of crate stacks (6) above the channel (14).

Claim 35. The system according to ~~any of~~ claim~~s~~ 1~~-4~~ or claim 2, wherein each track (10) is configured to support a pallet comprising four stacks of crates (6) arranged in a 2x2 arrangement.

Claim 46. The system according to any one of claims 1-3, ~~or any of claims 4 and 5 when dependent on claim 3,~~ wherein each of the ~~pair of~~first and second walls (12) comprises a solid~~, opposing~~ wall~~s~~, wherein the first and second walls (12) are arranged parallel to each other.

Claim 57. The system according to claim ~~3 or 6~~4, wherein each of the first and second walls (12) ~~is a solid wall and~~ separates the channel (14) from an adjacent gutter (16).

Claim 68. The system according to any ~~preceding~~ one of claims 1 to 5, wherein the climate chamber (2) further comprises a plurality of air inlets (18) and a plurality of air outlets (20).

Claim 79. The system according to any ~~preceding~~ one of claims 1 to 6, wherein the at least one air inlet (18) and/or the at least one air outlet (20) are provided in a ceiling (22) of the climate chamber (2).

Claim 8~~10~~. The system according to any ~~preceding~~ one of claims 1 to 7, wherein the climate chamber (2) is divided into a plurality of sub-chambers (2a).

Claim 9~~11~~. The system according to claim ~~10~~8, wherein each sub-chamber (2a) has a first side wall and a second side wall, and a first track (10) and a second track (10),

Wherein the first track (10) is separated from the first side wall by a first gutter (~~32~~28),

wherein the first track (10) is separated from the second track (10) by a second gutter (~~28~~32), and

wherein the second track (10) is separated from the second side wall by a third gutter (36).

Claim 10~~12~~. The system according to claim ~~11~~9, when depending from claim ~~8~~6, wherein the plurality of air inlets (18) are arranged above the second gutter (32), and wherein the plurality of air outlets (20) are arranged above the first gutter (28) and the third gutter~~s~~ (36).

Claim 11~~13~~. The system according to any ~~preceding~~ one of claims 1 to 10, further comprising a control system (1) configured to maintain a pressure gradient between the inlet openings (~~18~~48) and the outlet openings (~~20~~48), wherein a pressure at the inlet openings is higher than a pressure at the outlet openings, such that air flows from the inlet openings, through the climate chamber (2), and out of the outlet openings.

Claim 12~~14~~. The system according to any ~~preceding~~ one of claims 1 to 11, further comprising at least one sensor (52) configured to measure at least one environmental condition within at least one of the plurality of crates (4).

Claim 13~~15~~. The system according to claim ~~14~~12, wherein the at least one environmental condition includes one or more of:

temperature;
humidity;
oxygen concentration;
carbon dioxide concentration;
pressure; and
air flow.

Claim 14~~16~~. The system according to claim ~~14~~12, wherein the at least one sensor (52) is arranged in a base of the crates (4).

Claim 15~~17~~. The system according to claim ~~8~~ 6 or any preceding claim depending from claim 8, wherein the plurality of air inlets (18) are arranged along a duct (68), wherein the duct is configured to be supplied with climate controlled air via a master inlet (70).

Claim 16~~18~~. The system according to claim ~~17~~15, wherein the duct (68) has a variable height H, and wherein the height of the duct decreases as the distance from the master inlet (70) increases.

Claim 17~~19~~. The system according to claim ~~17~~ 15 or claim ~~18~~16, wherein the system further comprises a conduit (38) in fluid communication with the duct (68), and wherein the conduit comprises a flexible conduit comprising a plurality of holes (40) along opposing sides.

Claim 18~~20~~. The system according to any ~~preceding~~ one of claims 1 to 17, wherein the climate chamber (2) is provided in a static structure.

Claim 19~~21~~. The system according to any ~~preceding~~ one of claims 1 to 18, wherein the climate chamber (2) is provided in a portable container, e.g. a shipping container, a reefer, a truck trailer.

Claim 20~~22~~. The system according to claim ~~13~~ 11 or any preceding claim depending from claim ~~13~~11, wherein the control system (1) is configured to adjust at least one of the following parameters based on environmental conditions detected by at least one sensor:

temperature;
humidity;
oxygen concentration;
carbon dioxide concentration;
pressure at the inlet and/or outlet; and
air flow.

Claim 21~~23~~. The system according to any ~~preceding~~ one of claims 1 to 20, wherein the climate chamber (2) further comprises at least one rail (52) extending in the second direction adjacent open ends of the at least ~~one~~ two tracks.

Claim 2224. The system according to claim 2321, wherein a track of the at least ~~one~~ two tracks comprises a ledge (14a) on an internal surface of the ~~upstanding~~ first wall and second wall (12) with respect to the channel (14), which provides runners along which a robotic device (86) ~~or manned lifting device~~ can run.

Claim2325. The system according to claim ~~23 or 24~~22, wherein the at least one rail (1452) is configured to convey ~~a~~ the robotic device (86) in a perpendicular direction, in front of the open ends of the ~~channels (14)~~at least two tracks, wherein optionally the robotic device (86) comprises a frame (88) or carrier (88) configured to travel along the at least one rail (~~s~~52), and comprises a robot unit configured to travel along ~~the at least one track (10) or along~~ the runners in the channel (14) formed by the ledges (14a).

Claim 2426. The system according to any ~~preceding~~ one of claims 1 to 23, wherein the climate chamber (2) further comprises at least one robotic device (86) configured to move along the at least one track (10).

Claim 2527. The system according to any one of claims 1~~-~~ to 2624, further comprising at least one robotic device (86) configured to freely move and

place one or more crates (4) into the first and/or the second stack of crates (6), or

take one or more crates from the first and/or the second stack of crates.

Claim 2628. A method for rearing invertebrates, the method comprising the steps of:

(i) providing a plurality of crates (4), each crate having a first opening (48) in a first wall (46) and a second opening (48) in a second wall (46) opposite the first opening (48) to define a first air flow path (80) between the first and second openings;

(ii) filling at least a portion of each crate of the plurality of crates with a substrate and a plurality of invertebrates at a first developmental stage;

(iii) stacking the plurality of crates;

(iii) providing a climate chamber (2) comprising:

an internal volume enclosed by walls, a floor, and a ceiling;

a first row of air outlets (20) extending in a first direction within the internal volume;

a second row of air outlets (20) extending parallel to the first row of air outlets within the internal volume;

a row of air inlets (18) located between the first and second rows of air outlets, and extending parallel thereto, and spaced apart from the first and second rows of air outlets in a second direction, perpendicular to the first direction;

at least one first stack of crates (6) arranged in a space between the first row of air outlets and the row of air inlets;

at least one second stack of crates (6) arranged in a space between the second row of air outlets and the row of air inlets;

a conduit (38) extending from each of the plurality of air inlets between the first and second stack of crates, said conduit comprising a plurality of conduit openings (40) configured to align with inlet openings (48) of the plurality of crates in each stack; and

at least ~~one~~ two tracks (10) extending in the first direction with the climate chamber, ~~said~~ wherein each track of the at least two tracks (10) comprises~~ing~~ a first wall (12) and a second wall (12), and a channel (14) defined there between;

(iv) positioning the at least one first stack of crates (6) and the at least one second stack of crates (6) on ~~said~~ a corresponding track of the at least two tracks (10) wherein the crates are arranged with the airflow path oriented perpendicular to the first direction and in the second direction;

(v) applying a pressure differential between the air inlet and the air outlet.

~~29. The method according to claim 28, wherein the at least one track (10) is positioned between the first row of air outlets (20) and the row of air inlets (18), and wherein the system preferably comprises a second track (10) positioned between the row of air inlets (18) and the second row of air outlets (20).~~

~~30. The method according to claim 29 or claim 30, wherein the at least one track (10) comprises a pair of walls (12) separated from each other by a channel (14), said channel extending in a second direction, which is perpendicular to the first direction; and~~

~~optionally, wherein the at least one stack of crates (6) is arranged on the tracks such that the airflow path (80) extends in the first direction.~~

Claim 27~~31~~. The method according to claim ~~30~~26, wherein each of the ~~pair of~~first and second walls (12) comprises a solid~~, opposing~~ wall~~s~~, wherein the first and second walls (12) are arranged parallel to each other.

Claim 28~~32~~. The method according to claim ~~30 or 31~~27, wherein each of the first and second walls (12) ~~is a solid wall and~~ separates the channel (14) from an adjacent gutter (16).

Claim 29~~33~~. The method according to any one of ~~the~~ claims ~~30-32~~26 to 28, wherein the method further comprises providing a plurality of air inlets (18) and a plurality of air outlets (20), and positioning at least one stack (6) between an air inlet and an air outlet aligned with each other in the first direction.

Claim 30~~34~~. The method according to any one of claims ~~28-33~~26 to 29, wherein the method further comprises: sensing, using at least one sensor (52), an environmental condition within one or more of the plurality of crates (6), where in the sensed environmental condition can comprise one or more of:

temperature;

humidity;

oxygen concentration;

carbon dioxide concentration;

pressure; and

air flow.

Claim 3135. The method according to claim 3430, further comprising controlling at least one of the following parameters based on the sensed environmental conditions within the crates:

temperature;

humidity;

oxygen concentration;

carbon dioxide concentration;

pressure at the inlet and/or outlet; and

air flow.

Claim 3236. The method according to any one of claims 28-3526 to 31, wherein the method further comprises arranging a plurality of stacks of crates (6) in rows along the tracks, wherein each stack abuts an adjacent stack in the second direction.

Claim 3337. The method according to any one of claims 28-3626 to 32, wherein the stacks (6) are arranged in a 2 x 2 arrangement.

Claim 3438. The method according to any one of claims 28-3726 to 33, further comprising, operating a robotic device (86) to move along a track of the at least one two tracks (10), wherein the robotic device is configured to:

move at least one stack of crates (6) along the tracks;

detect environmental conditions within the channel (14);

read information from at least one crate (4) stacked above the channel.

Claim 3539. The method according to any one of claims 28-3826 to 33, further comprising, operating a robotic device (86) to freely move and:

place one or more crates (4) into the first and/or the second stack of crates (6), or

take one or more crates from the first and/or the second stack of crates.

Claim 3640. The method according to any one of claims 28-3926 to 35, wherein the method further comprises conveying a robotic device (86) in the second direction, in front of the open ends of the channels (14)at least two tracks (10), wherein the climate chamber (2) comprises at least one rail (52) extending in the second direction adjacent the open ends of the at least one two tracks (10) wherein the at least one rail is configured to convey the robotic device (86), optionally the robotic device (86) comprises a frame (88) or carrier (88) configured to travel along the at least one rail(s), and comprises a robot unit configured to travel along a track of the at least one two tracks (10) or along the runners in the channel (14) formed by the ledges (14a).

Claim 3741. The method according to claim 4036, wherein the track of the at least two tracks (10) comprises a ledge (14a) on an internal surface of the first and second wall (12) with respect to the channel (14), which provides runners along which the robot unit can run, further comprising running a the robot device (86) or manned lifting deviceunit along the runners in the channel (14) formed provided by the at least one track (10) comprising a ledge (14a) on an internal surface of the upstanding wall (12) with respect to the channel (14).

Claim 3842. An invertebrate rearing crate (4) suitable for use in the system of any one of claims 1-27 to 25 or in the method of any one of claims 28-4126 to 37, characterized in that the crate (4) comprises a base, upstanding opposing side walls (44) without openings (48) and withhaving a length L, and upstanding opposing end walls (46) with having a length W, defining a perimeter around the base, whereby W is less than L, wherein openings (48) are formed in the opposing end walls (46), as well as at least one projection (56) in an upper edge surface (54) thereof, and at least a corresponding recess (60) in a lower edge region (58), the recess being configured to receive a projection of a further crate on which it is stacked; and at least one sensor mounting region (50) arranged in the base of the crate.

Claim 3943. The invertebrate rearing crate according to claim 4238, wherein the base further comprises a plurality of sensors (52) arranged in the base of the crate.

Claim 4044. The invertebrate rearing crate according to any of claims 42-4338 or claim 39, wherein the crate further comprises a first receiving portion (62) configured to receive a removable identification tag, e.g., an RFID tag.

Claim 4145. The invertebrate rearing crate according to claim 4440, wherein the crate further comprises a second receiving portion (62) positioned on an opposing side of the crate in a corresponding position, such that the position of the second receiving portion maps the position of the first receiving portion when the crate is rotated 180 degrees about a vertical axis.

Claim 4246. The invertebrate rearing crate according to claim 4541, wherein the second receiving portion comprises an identification tag, e.g., an RFID tag.