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DESCRIPTION

[0001] The present invention relates to an apparatus and a method for growing baby crustaceans, such as crabs or lobsters and other members of the order of crustaceans known as Decapoda.

[0002] A variety of shellfish and fish are raised successfully through aquaculture or fish farms. For example GB 2 168 231 A describes a vessel for raising fish or shrimps, consisting of a generally cylindrical vessel with a stepped conical base, and with a coaxial downpipe on its axis extending from a weir. Water is introduced tangentially near the bottom of the cylindrical wall, and flows out through the downpipe. Radial mesh walls subdivide the vessel into sectors for fish of different sizes, and the angles between the mesh walls are adjusted as the fish grow, so as to ensure an optimum weight of fish per unit volume.

[0003] Lobsters, however, are not easy to raise in captivity, two of the problems being that lobsters in close proximity tend to eat each other; and that lobsters grow very slowly, taking several years to grow to a commercial size. Another approach is to keep lobsters captive only from the stage of the egg hatching to the fourth or fifth growth stage, at which point they start to settle on the bottom. This is advantageous because when lobsters initially hatch, the young lobsters are very small, and initially live in a planktonic fashion, freely floating in the sea. At this stage the lobsters are likely to suffer predation, being eaten by other creatures. When the lobsters have reached the size at which they settle on the bottom, the hatchery operators free the baby lobsters into the sea, hoping that they survive in the wild long enough to grow to maturity. Crabs may also be raised in this way, and then released into the wild. For example, after hatching, blue crabs can grow to a size of about 20 mm, after 6-7 moults, over a period of about two months, and then can be released.

[0004] An aim of the present invention is to provide an apparatus to improve the conditions for such baby crustaceans while ensuring they do not eat each other, until they grow large enough that they can fend for themselves.

[0005] According to the present invention there is provided an apparatus suitable for growing baby crustaceans, as specified in claim 1.

[0006] Preferably the apparatus comprises two recirculation means. The first recirculation means preferably also circulates the water through the biofilter to remove any toxins. The second recirculation means provides an alternative and adjustable flow of water through the apparatus, and would be used when feeding the baby crustaceans.

[0007] Whenever the baby crustaceans are being provided with food, the second recirculation means would be activated (rather than the first recirculation means). An operator can easily pour food material into the recirculating water at the top end of the duct, so that it is carried down the duct and distributed to the tank.

[0008] During periods when the baby crustaceans are not being fed, the first recirculation means would be activated (rather than the secondary circulation means). The first recirculation means produces a larger flow rate of water. By circulating the water through the biofilter any toxins are removed, and the recirculation avoids the development of stagnant regions of water within the tank.

[0009] The perforations in the base of the trays may be of diameter between 1 mm and 3 mm. Such trays are particularly suitable for baby crustaceans that are of a size greater than about 3 mm. The perforations ensure that the water circulates through every compartment of every tray. Preferably the first recirculation means produces a swirling flow at the inlet to the tank, so that the pressure causing the flow of water through the trays is substantially uniform across the tank.

[0010] The invention also provides a method of growing baby crustaceans according to claim 9 using such an apparatus. The method preferably involves circulating the water through a biofilter for some period of time; and then circulating the water without passing through the biofilter while providing the baby crustaceans with food. These two circulation steps are applied alternately and repeatedly.

[0011] The invention will now be further and more particularly described, by way of example only, and with reference to the accompanying drawings in

Figure 1 shows a longitudinal sectional view through an apparatus of the invention; and

Figure 2 shows a transverse sectional view on the line 2-2 of figure 1, also showing the external flow components diagrammatically.

[0012] Referring to figure 1 an apparatus 10 for growing baby lobsters comprises a cylindrical tank 12 which may for example be of internal diameter 400 mm. In this example the tank 12 has an upper part of length 650 mm defined by a transparent acrylic tube 14 with external flanges 15 at each end, and a lower part defined by a 100 mm section of PVC tube 16 to the upper edge of which is fixed a flat ring 17 of PVC. The flat ring 17 defines an external flange, and bolts 20 are used to connect the acrylic tube 14 to the flat ring 17; the flat ring 17 also projects about 10 mm inside the tube 16, so defining an internal flange.

[0013] The bottom of the tank 12 is defined by a flat plate 22 of PVC fixed to the bottom of the section of PVC tube 16. Below the tank 12 is a base chamber 30, defined by a 100 mm section of PVC tube 32, and closed at its bottom by a base plate 34 also of PVC. The flat plate 22 defines a central aperture into which is fixed a PVC pipe 36 that extends upwardly along the longitudinal axis of the tank 12 to near the top of the tank 12, the pipe 36 being open at each end. This pipe 36 hence provides communication between the base chamber 30 and the top part of the tank 12. The outer surface of the pipe 36 is threaded from its top down to within the PVC tube 16, the lowermost portion of the outer surface not being threaded, and a PVC nut 37 is screwed onto the pipe 36 so that the upper edge of the nut 37 is at the same height as the top of the flat ring 17.

[0014] Within the tank 12 several trays 40 are arranged as a stack (only the top and bottom trays 40 being shown, for clarity). Each tray 40 is annular, so as to locate in the annular space between the pipe 36 and the tube 14, and the bottom tray 40 rests on the nut 37 and on the internal flange provided by the flat ring 17. Each tray 40 defines an array of perforations 42 each of diameter 3 mm, spaced apart by about 10 mm; and on its upper face are projecting fins 44 defining a multiplicity of open-topped compartments 46. Typically a compartment 46 might have dimensions 50 mm by 25 mm, so that several perforations 42 communicate with each compartment 46. By way of example the compartments 46 might be of rectangular shape in plan, or might be of hexagonal shape or half-hexagon shape, or triangular shape in plan; the preferred embodiment has half-hexagonal shaped compartments 46. In use one baby lobster would be put into each compartment 46 of each tray 40; the fins 44 ensure that the lobsters do not have access to one another, so there is no risk of them eating each other. Each tray 40 is covered by a 3 mm sheet 47 of nylon mesh defining 2 mm holes, ensuring that the lobsters remain within the compartments 46. The top tray 40, which does not contain any lobsters, is secured by a collar 48 screwed onto the top of the tube 36.

[0015] Referring also to figure 2, two pipes 50 and 51 communicate with the base chamber 30, being arranged diametrically opposite each other. The pipe 50 is of diameter 50 mm whereas the pipe 51 (not shown in figure 1) is of diameter 25 mm. Two pipes 53 and 54 communicate with the annular lower part of the tank 12 defined by the PVC tube 16. The pipe 53 is of diameter 50 mm and, as shown particularly in figure 2, is aligned along a non-radial path; the pipe 54 is of diameter 25 mm, and is aligned radially.

[0016] As shown in figure 2, the pipes 50 and 53 are each provided with valves 55, and are connected via biofilter 58 and a recirculation pump 60 to form a first recirculation loop 62. This first recirculation loop 62 also includes valves 63, 64 and a T-junction 65 communicating with a source of seawater. The pipes 54 and 51 are provided with valves 66, and are connected via a recirculation pump 68 to form a second recirculation loop 70.

[0017] In use of the apparatus 10 the trays 40 with baby lobsters in the compartments 46 and the cover sheets 47 are put into the tank 12, and are secured with the collar 48. Typically the lobsters would be about eight days old, and of length about 10 mm when first introduced into the apparatus 10. The tank 12 is then filled with seawater 75 to the top of the pipe 36; this may be achieved by opening valve 64, closing valve 63, and pumping seawater using the pump 60 into the pipe 53 and so into the tank 12. The apparatus 10 is then operated alternately in two different modes, non-feeding and feeding, repeatedly. Typically the non-feeding mode would be used most of the time, repeatedly. Typically the non-feeding mode would be used most of the time, while feeding would be applied for intervals of a few minutes once or twice a day.

[0018] In the non-feeding mode the seawater is recirculated through the recirculation loop 62, with the valve 64 closed and the valve 63 open. In this case the seawater is pumped vigorously into the annular lower part of the tank 12 below the trays, swirling around in this annular space because the duct 53 is not radial, and flowing upwardly through the trays 40, and then draining down the pipe 36. The swirling flow within the annular space below the trays 40 ensures substantially uniform pressure below the trays 40, and hence ensures substantially uniform flow over the entire cross-section of the tank 12. The seawater is recirculated through the biofilter 58 (shown diagrammatically) in which bacteria are arranged to remove or destroy toxins that might be present in the seawater, and in particular to break down nitrogenous waste material excreted by the lobsters. This may for example contain a bed of particulate material on which autotrophic bacteria grow; such bacteria can convert ammonium ions to nitrate ions.

[0019] To change to the feeding mode, the outlet valve 55 on the pipe 50 would be closed, so that the seawater flowing down the pipe 36 would gradually fill the base chamber 30 and the pipe 36. When the pipe 36 is almost full, the pump 60 would be switched

off and the valve 55 on the inlet pipe 53 closed. In the feeding mode the seawater is recirculated through the recirculation loop 70. A foodstuff such as freeze-dried zooplankton mixed with water would be poured into the top of the tank 12, preferably into the top of the pipe 36, so that it is carried down the pipe 36, around the recirculation loop 70, and then pumped upwardly through the trays 40 in the tank 12. By way of example a suitable foodstuff is freeze-dried *Calanus* spp. such as *C. finmarchicus*. The flow rate during the feeding mode is significantly less than that during the non-feeding mode, and is such that the baby lobsters can catch the zooplankton as it passes through the compartments.

[0020] After recirculating in this feeding mode for a short period of time, such as five minutes, the apparatus 10 would be changed back to the non-feeding mode. This would entail switching off the pump 68 and closing the valves 66; would recirculate through the recirculation loop 62. Any foodstuff that is carried in the recirculating water out of the tank 12 will be caught by the biofilter 58.

[0021] Occasionally, when in the non-feeding mode, it may be desirable to drain out a proportion of the seawater, by turning off the recirculation pump 60 and opening both the valves 63 and 64 for a short period, and then replenishing with fresh seawater by closing the valve 63 and actuating the pump 60 for a short period. The normal recirculation can then be restarted. It will be appreciated that the recirculation loop 62 might also include other water-treatment units, such as a mechanical filter to remove particulate material, an activated carbon absorption pack, or a protein extractor, for example using vigorous air bubbling.

[0022] It will be appreciated that, in the non-feeding mode, the apparatus 10 might instead be operated in a once-through flow fashion, with valve 63 closed and valve 64 open, so the pump 60 provides fresh seawater to the tank 12; in this case the seawater emerging through the pipe 50 would be fed directly to drain.

[0023] One advantageous consequence of the pumped recirculation in both the feeding mode and the non-feeding mode is that the seawater within the apparatus 10 is at a temperature a few degrees above ambient, for example 5°C above ambient temperature, because of the energy from the recirculation pump 60 or 68, and this elevated temperature increases the growth rate of the lobsters. The apparatus 10 has been found suitable for growing lobsters until they get to a length of between 25 and 30 mm, this taking a period of about six weeks, and the young lobsters can then be released into the wild.

[0024] It will be appreciated that the apparatus 10 described above is by way of example only. An apparatus for growing baby crustaceans may differ from that described, for example being of different dimensions. An apparatus of the invention might be used for growing baby crabs or scampi, rather than for growing lobsters. The apparatus may also be modified in various ways. For example the inlet pipe 54 used during the feeding mode might be aligned non-radially, so that during feeding the recirculated water swirls around the bottom of the tank 12 below the trays 40.

[0025] It will be appreciated that the apparatus 10 enables the crustaceans to be fed while ensuring that the water does not contain toxins, so that the crustaceans grow well while remaining healthy.

[0026] It will be appreciated that several of the apparatuses 10 may be connected to a common recirculation loop 70. In larger systems it may be advantageous to operate a feeding cycle which provides food simultaneously to several of the apparatuses 10. The individual pump 68 on each apparatus 10 would be replaced by a single larger pump which would take water from the outlet pipes 51 of several apparatuses 10, and recirculate it to the corresponding inlet pipes 54; in this case the system would preferably also provide an alternative feeding port through which food can be introduced into the system.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- [GB2168231A \[0002\]](#)

P A T E N T K R A V

1. Apparat (10) til opdrætning af krebsdyrunger, hvor apparatet omfatter:
en cylindrisk tank (12) med et i det væsentlige cirkulært tværsnit til at indeholde
vand; en kanal (36), som strækker sig opad langs længdeaksen af tanken (12) til
5 en position nær toppen af tanken, og et kammer (30) under tanken (12), hvor
kanalen (36) strækker sig ud fra kammeret (30);
og k e n d e t e g n e t ved, en flerhed af ringformede bakker (40) anbragt i en
stak og befindende sig mellem kanalen (36) og den cylindriske tank (12), hvor
hver bakke (40) definerer rum (46) til at rumme krebsdyrungerne, hvor bakkerne
10 (40) har perforeringer (42) i deres basis til gennemstrømning af vand;
og et middel (62) omfattende et biofilter (58), til at passere vand gennem kanalen
(36) og tanken (12) og tillige gennem biofilteret (58) i en ikke-fodringstilstand; og
yderligere et middel (70) til at recirkulere vand gennem kanalen (36) og tanken
(12) i en fodringstilstand.
- 15 2. Apparat ifølge krav 1, hvor mindst ét recirkulationsmiddel (53) er forbundet til
basisområdet (16) af tanken (12) på en sådan måde, at der tilvejebringes en hvir-
velstrøm af vand omkring tankens (12) basisområde (16).
3. Apparat ifølge krav 1 eller krav 2 omfattende to recirkuleringsmidler (62, 70), hvor
midlet til at passere vand gennem kanalen (36) og tanken (12) i en ikke-fodrings-
20 tilstand er et første recirkulationsmiddel (62), som cirkulerer vandet gennem bio-
filteret (58).
4. Apparat ifølge et hvilket som helst af de foregående krav, hvor recirkulationsmidlet
(70) til anvendelse i fodringstilstanden er indrettet til at tilvejebringe en strøm-
ningshastighed, som er lig med eller mindre end den i ikke-fodringstilstanden.
- 25 5. Apparat ifølge krav 3 yderligere omfattende et middel (64) til at vand kan blive
drænet fra det første recirkulationsmiddel (62), og til at blive genopfyldt.
6. Apparat ifølge krav 3 eller krav 5, hvor det første recirkulationsmiddel (62) også
indbefatter en anden vandbehandlingsenhed.
7. Apparat ifølge et hvilket som helst af de foregående krav, hvor hver bakke (40) er
30 dækket med en net-plade (47).
8. Apparat ifølge krav 1 eller krav 2, hvor apparatet (10) i ikke-fodringstilstanden er

indrettet således, at vand kan ledes gennem tanken (12) på en måde med én gennemstrømning.

9. Fremgangsmåde til opdrætning af krebsdyrunger ved at anvende et apparat (10) ifølge et hvilket som helst af de foregående krav.
- 5 10. Fremgangsmåde ifølge krav 9 omfattende at cirkulere (62) vandet gennem biofilteret (58) i et tidsrum; og derefter at cirkulere (70) vandet uden at passere gennem biofilteret (58), mens at krebsdyrungerne forsynes med mad, idet disse to cirkulation trin udføres skiftevis og gentagne gange.

DRAWINGS

Fig.1.

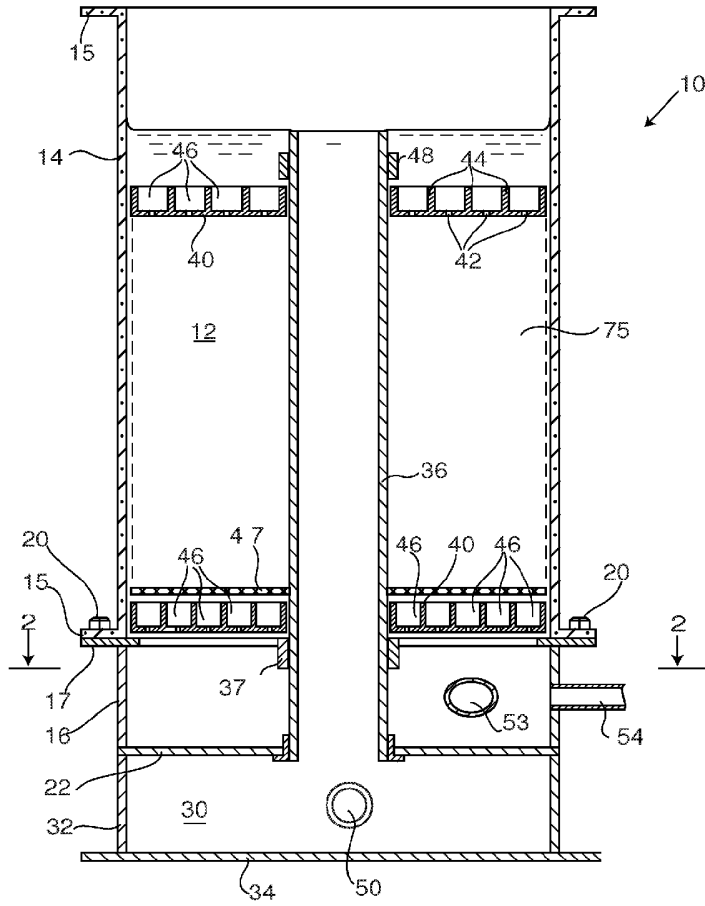


Fig.2.

