(57) Abrégé/Abstract:
The present invention provides for an off-shore unitary fish farming apparatus, comprising: a plurality of floatable fish containers aligned sequentially having attachment means for flexibly connecting the containers to maintain the containers in a predetermined relationship to one another, a dampening means attached to at least one of the containers to reduce current and wave and also deflect any floating debris away from the containers, a fish feed tank for holding, mixing and distribution of fish feed slurry to each of the plurality of fish containers, the fish tank having a securing means for attaching the dampening means to the tank, a feed dispenser for radially dispensing fish feed in the container directly beneath the water surface, anchor means to anchor the apparatus to an aquatic floor, the anchor means allowing radial movement of the tank around an anchor position and a crane mounted on the fish feed tank.
ABSTRACT

The present invention provides for an off-shore unitary fish farming apparatus, comprising: a plurality of floatable fish containers aligned sequentially having attachment means for flexibly connecting the containers to maintain the containers in a predetermined relationship to one another, a dampening means attached to at least one of the containers to reduce current and wave and also deflect any floating debris away from the containers, a fish feed tank for holding, mixing and distribution of fish feed slurry to each of the plurality of fish containers, the fish tank having a securing means for attaching the dampening means to the tank; a feed dispenser for radially dispensing fish feed in the container directly beneath the water surface, anchor means to anchor the apparatus to an aquatic floor, the anchor means allowing radial movement of the tank around an anchor position and a crane mounted on the fish feed tank.
AN OFFSHORE AQUACULTURE SYSTEM

This invention relates to an aquaculture system; more particularly, one aspect of this invention relates to a novel system for aquaculture, particularly useful in environments where the aquaculture system is exposed to the elements (such as in an open ocean environment).

Fish aquaculture is well known and forms an established industry in many different countries. Known systems generally rely on the use of cages for raising fish, in which the feeding of the fish is controlled using various types of known feeding devices which can either be automated or manually operated.

Generally speaking, fish "farms" are located in relatively quiet harbour conditions where the weather and ocean environments are not severe as in an open ocean location. The use of such aquaculture systems under relatively calm conditions (i.e. free from wind, current, wave action, etc.) is desirable in order to minimize potential damage to equipment and to provide for controlled feeding.

With the growing aquaculture industry, many of the relatively good locations (such as quiet harbours) are reaching the point of saturation in terms of the capability of such harbours handling a given number of aquaculture systems; in other cases, the harbours under certain conditions are becoming polluted by the effluent from the aquaculture farming, and in still further situations, the increasing number of aquaculture systems is creating a problem for the use of harbours for ship, boat or similar traffic in terms of potential collisions between such traffic and anchored fish cages.

It has also been found in recent studies that placing aquaculture cages in water there is an active movement of the water can be desirable in terms of raising fish. Not only does the flow of water aid in the dispersal of effluent, but it appears to have beneficial effects on the raising of fish.
With modern technology, fish farms using cages often have very large fish populations in such cages - typically 50,000 to more than 100,000 fish can be raised under controlled conditions in a single cage. The amount of food required for such a large fish population poses another problem for the aquaculture industry, since feed supply systems must be continuously refilled or ready access to individual cages using manual feeding systems has to be provided for.

It would be desirable to develop and aquaculture system which would not be restricted to areas such as harbours but rather, could be located in the open ocean under controlled conditions which would permit raising of fish in a manner similar to that employed in protected areas such as harbours. One of the problems that would be created using an open ocean environment for the fish cages is the fact that ocean currents could cause severe problems for a successful operation; it has been found that when fish are exposed to strong flowing current conditions, the fish population can die. While limited amounts of current are desirable, excessive current is undesirable. Moreover, any ocean aquaculture system would have to be structurally designed so as to permit several fish cages to be contained within a defined area, yet permitting the plurality of cages to adapt to different current conditions when currents change. This would require a freely movable system anchored generally at a fixed point, which system could be rotatable or movable about such a fixed point.

Moreover, any ocean aquaculture system would have to be designed in such a manner that wave conditions, as well as wind conditions, would have a minimal effect on the aquaculture system, particularly for feeding or food distribution amongst several fish cages. Under quiet harbour conditions, exposure of the upper portions of fish cages would not be a detrimental factor. But, under open ocean conditions, waves or wind can cause damage to such systems.

When considering ocean aquaculture systems, other weather conditions such as freezing rain, snow, and the like must also be take into consideration, particularly when employing an automated feeding system. Under certain conditions, the build-
up of ice on an ocean system, particularly on a feed distribution system, could be disastrous in terms of maintaining fish under healthy conditions.

SUMMARY OF THE INVENTION

The present invention provides an aquaculture system which is capable of being located in open ocean conditions and can account for current or like factors which can be encountered under typical ocean circumstances.

More particularly, the present invention provides for a containment system for feeding fish in an environmentally exposed aquatic site, which comprises a storage unit for fish feed having a single point connection and being capable of being anchored to a sea bed; a current deflector connected to the single point connection for dampening current and waves; a plurality of cages sequentially arranged in parallel and axially extending from the current deflector, with the cages being displaced from one another by flexible positioning means enabling the cages to move relative to one another while remaining as a unit and without contacting one another. The cages are adapted to have an upper portion float above a body.

A further embodiment of the present invention provides for an off-shore unitary fish farming apparatus, which comprises a plurality of fish containers aligned sequentially having attachment means for flexibly connecting the containers to maintain the containers in a predetermined relationship to one another; a dampening means is attached to at least one of the containers to reduce current and wave effects on the containers, a fish feed tank for holding, mixing and distribution of fish feed slurry to each of the plurality of fish containers, the fish tank having a securing means for attaching the dampening means to the tank; and, anchor means to anchor the apparatus to an aquatic floor, the anchor means allowing radial movement of the tank around an anchor position.

In a still further embodiment of the invention there is provided apparatus wherein the fish feed tank is remotely actuated. In yet another embodiment, the invention
provides a fish feed tank including a crane.

In a further particularly preferred embodiment of the invention, the fish feed tank is structured to have a low centre of gravity for stabilizing the tank. In a further preferred embodiment, the invention provides apparatus wherein the fish feed tank acts as a stabilizer for the apparatus.

In a preferred embodiment of the invention, there is provided apparatus wherein the fish feed tank further includes securing means for securing the current deflector to the fish feed tank unit.

In yet another embodiment of the invention, the fish feed tank further includes storage means and pumping means for pumping slurry feed to the plurality of cages.

A particularly preferred embodiment of the invention provides a fish feeding system which comprises a plurality of fish containers having flexible positioning means connecting the containers and maintaining the containers in a predetermined relationship; the containers have an upper portion which is capable of floating above the water; also provided are means for maintaining the containers in alignment in a row; connection means between adjacent containers; and dampening means attached to at least one of the containers to reduce current and wave effects on said wave containers.

A further particularly preferred embodiment of the invention provides means connecting a leading one of the cages to a deflector. The connection means comprises means for connecting and positioning each cage in a row.

In a still further preferred embodiment, the present invention provides a fish feeding system wherein the system further includes an angled deflector, which includes a pair of arms extending in a V-shaped and which includes a support means extending between the V-shaped arms.
Another preferred embodiment of the present invention provides for the containers to further include connection means adapted for connection to a feeding unit.

A further preferred embodiment of the invention provides a fish feeding system, wherein the upper portion of the containers includes a foam material. In a preferred embodiment, the containers comprise an open mesh material.

In a still further particularly preferred embodiment of the invention, there is provided a mooring pole device suitable for connecting a plurality of anchor means and for connecting a guy cable, which comprises an elongate substantially non-flexible body having one end including a plurality of securing means, each of the plurality of securing means is adapted to provide an anchor connection, and an opposed end having connection means for a guy cable; the connection means are rotatable relative to the elongate member.

A particularly preferred embodiment of the invention provides fish containers including means for dispensing feed into the container.

In yet a further preferred embodiment, the dispensing means comprises means for distributing feed within each container below the surface of an aqueous body in which the containers are positioned.

In another preferred embodiment of the invention, each of the containers is provided with an apparatus for dispensing a slurry feed suitable for fish feeding under the surface of an aqueous body, with the apparatus comprising a housing having a feed inlet and a radial feed dispensing means; means for providing a slurry containing a feed product to said feed inlet means in the housing; and radial feed dispensing means comprising a plurality of spaced-apart slurry dispensing outlets therein for dispensing slurry radially and outwardly from the housing under the surface of the aqueous body.

A still further preferred embodiment of the invention provides an apparatus wherein
the housing comprises an elongated chamber having upper and lower portions, with the radial feed dispensing means being at the upper portion and being adapted to radially dispense a plurality of slurry streams containing the feed about the peripheral area extending outwardly from the upper portion of the housing.

5 Another preferred embodiment of the present invention provides feed dispensing outlets wherein the outlets are in the form of channels and each of which comprises a trough-shaped channel in a dispensing member and comprise a plurality of spaced-apart channels extending outwardly from a central portion of said housing, with channels being balanced about the periphery of the housing with opposed ones of the channels balancing channels on an opposed side of the housing.

A still further preferred embodiment of the invention comprises apparatus having a trough-shaped channel in a dispensing member, the channels having an outlet section at one end thereof, and means for deflecting feed projected from the outlet section in a downwardly extending direction. In yet another preferred embodiment of this invention there is provided a directional thruster to permit the housing to rotate about a central axis.

In a further preferred embodiment, the directional thruster includes thrust diversion means adapted to permit the apparatus to change movement direction.

In a still further preferred embodiment, there are provided an equal number of dispensing outlets arranged in a circumferential manner in a spaced-apart equidistant configuration.

In a further preferred embodiment of the invention the apparatus includes a flotation element. In yet another preferred embodiment of the invention, the apparatus includes ballast adapted to stabilize the apparatus when dispensing slurry feed.

25 The present invention thus provides a novel apparatus and method for permitting aquaculture in ocean surroundings. Thus, this system will open up a new untapped
area for feeding fish where heretofore it has been generally impossible to carry on such a system in the open ocean. Moreover, the system of the present invention can be used in other bodies of water where it is desirable to have current protection for the aquaculture system.

5 Having thus generally described the invention, reference will now be made to the accompanying drawings illustrating preferred embodiments, and in which:

**Figure 1** is a top plan view of an over all system utilizing embodiments of the invention as disclosed herein;

**Figure 2** is a side elevational view of the system shown in Figure 1;

**Figure 3** is a side elevational view of the feed unit of one invention disclosed herein;

**Figure 4** is a top plan view of the unit of Figure 3;

**Figure 5** is a horizontal section taken along the line 5-5 of Figure 3;

**Figure 6** is a side elevational view of a mooring unit according to another invention disclosed herein;

**Figure 7** is a view similar to Figure 6 of a modified mooring unit;

**Figure 8** is a top plan view of a feed dispersal system used in each of the fish cages;

**Figure 9** is a side elevational view of the distribution system of Figure 8;

**Figure 10** is a view similar to that of Figure 9 showing the feed slurry distribution pattern in a body of water when the system of Figure 8 is in use; and

**Figure 11** is an enlarged partial vertical section view showing a preferred structure for the feed distribution system.

Referring initially to Figures 1 and 2, the overall system of one embodiment of the present invention as illustrated for use in fish aqua culture in an ocean environment where the system would be exposed to typical ocean conditions involving current flow, wind, etc. In the system shown, there are two rows of spaced apart fish cages indicated generally by reference numerals 10 A, 10 B and 10 C in a first row and 12a, 12b and 12c in a second parallel row. Each fish cage 10 or 12 can be of
conventional fish netting structure for the majority of the cage make-up; as such, the
cages may, for example, be 10 to 100 meters in diameter and each is typically
designed to hold a fish population of 10,000 to 800,000 fish.

The cage structure is generally of an open mesh configuration; the cages will be
designed to have a closed bottom or otherwise be permanently fixed to the sea bed.
In the embodiment shown in Figure 2, the cages have a depth less than the depth of
the water and generally float on the surface of the water with the balance of the cage
being suspended beneath the water surface. To this end, each cage may be
provided with suitable floatation means either due to the nature of the upper cage
structure or by the use of appropriate air cylinders or the like. Typically, the top of
the cage is desirably at or slightly above the top of the water surface, at least on the
periphery of the cage.

In Figure 2, the cages are of a type which are of a "closed" structure meaning that
the cage has a bottom mesh structure to close off its lower end.

Referring to Figure 1, as will be seen, and in accordance with the present invention,
each of the rows of cages are mounted in an arrangement such that the cages are
spaced from each other but as an overall unit, function to act as a single unit. To
this end, each of the cages is provided with means for laterally and horizontally
spacing the cages one from another; typically, semi-rigid or rigid connecting means
14 can be employed – e.g. bars or conduits which are moveably connected at their
respective ends to opposed cages.

Lengthwise, to this end, a plurality of similar spacers 16 pivotally or moveably
connect each of the cages 10 and 12 in a row. To maintain the series of cages 10
and 12 in their respective rows, confinement cables or bars 18 can be employed
extending along the outside of each of the rows and connecting one cage to
another. Such bars or cables 18 are moveably connected to each cage in
sequence, to permit relative movement of one cage to another, while maintaining
lengthwise alignment.
In accordance with the present invention, there is also provided a deflector means indicated generally by reference numeral 20, which is adapted to be at the "front" of the assembly of fish cages. This deflector is intended to have a primary function of deflecting any ocean currents and also any debris or refuse away from the fish cages and is composed of a pair of arms 22 mounted in a "v" shaped configuration in a generally rigid manner. One or more suitable braces 23 may be provided to join the arms 22 forming a generally rigid deflector assembly 20.

Arms 22 preferably extend outwardly of the outer lengthwise perimeter of the series of cages 10 and 12. Deflector 22 preferably has a depth at least equal to the depths of the cages 10 and 12 (see Figure 2) and may be composed of a mesh-type material (e.g. metallic mesh) which permits a certain amount of water flow through the mesh to enable fresh ocean water to pass through the cages 10 and 12; the mesh at the same time will function to deflect much of the current and debris around the cages to avoid damage to the fish within the cage.

Desirably, the deflector is anchored or connected to the previously described cage system and this can be achieved by use of appropriate connecting members or arms 26 extending transversely across the front of the cages between longitudinal supports 18 together with a plurality of connecting means 30 anchoring the deflector 22 to each of the first fish cage units 10a and 10b. In addition, a plurality of connecting means 30a may be connected between the lead cage 12a (and 10a) and the deflector 20 extending downwardly from the deflector 20 to spaced-apart points on the first cage (see Figure 2).

Reference will now be made to feed storage and distribution tank indicated generally by reference numeral 40 (see Figures 1 and 2) and shown in greater detail in Figures 3 to 5.

Generally speaking, the feed storage system is design to hold a relatively large supply of feed to be dispensed to each of the fish cages and is positioned normally in front of the current deflector 20 (as shown in Figure 1). The storage tank 40 is
most desirably designed so as to have a low center of gravity in order to minimize undesired wind and/or wave influences, etc.

As shown in Figures 3 to 5, storage tank 40 is mounted on a platform 42; the unit includes a downwardly and inwardly tapering bin 44 which is adapted to hold a supply of dry fish food (e.g. pellets). Depending on the size and number of fish cages, the bin 44 may be sized to provide several weeks or months supply of fish food.

The bin 44 includes suitable means (e.g. an auger or the like) indicated generally by reference numeral 46 adapted to feed fish food pellets to smaller mixing hoppers 48 (of which one or two can be included). Mixing chambers 48 are adapted to receive the dry pellets and to mix them into a slurry form with e.g. sea water. From the mixers 48, suitable conduit means are provided to connect the slurry feed to a pump 50 capable of forcing the slurry feed through a conduit 52 where it is distributed to the fish cages 10 and 12 (as will be described hereinafter in greater detail).

In the arrangement shown, a duplicate or identical back-up system is provided so that should one portion of the storage unit fail, duplicate mixing chambers 48a and pump 50a can be put into operation. It will be noted from Figure 5 that in the arrangement illustrated, all of the necessary pumps, mixing chambers, etc., are located on the outer peripheral edge of the bin in order to provide a compact system.

The arrangement shown in Figures 3 to 5 most desirably includes independent power means in the form of engines 54 and 54a, driven by a suitable source of fuel (e.g. such engines can be gas or electrically driven). Such engines will provide power for the pumping system, mixing chambers, and any other requirements in order to maintain the feed tank in an automated condition.

Desirably, there is also provided means for filling the bin 44 from a supply vessel or barge or the like; as illustrated in Figure 4 this may take the form of a crane referred to generally by reference numeral 56 suitably mounted to the feed unit; the crane
desirably has a movable arm rotatable around a fixed pivot point and may be provided with a bucket or a hydraulic or a pneumatic system. The crane is positioned to be in operative relationship to the top of the bin 44, which is normally provided with one or more hatch covers 58 capable of being movably displaced so as to refill the bin when desired.

Referring now to Figure 1 again, the feed storage unit 40 is fixedly secured to either or both of the deflector units 20 and the connecting means connecting the series of fish cages in alignment. To this end, a plurality of independently movable but pivotally attached cables 60 can be employed for this purpose. In this manner, the feed storage unit 40 will be retained in a fixed but independently movable relationship with the fish cages.

The feed storage unit may be provided with suitable buoyancy means in order to maintain a desired depth in the ocean; such buoyancy means can include structural materials designed to provide the desired buoyancy or air tanks/chambers.

Referring now to Figures 6 and 7 there is illustrated a further development used in connection with the anchoring system. More particularly, there is provided a novel mooring pole indicated generally by reference numeral 70, which consists of an elongated body 72 having at one end thereof a plurality of individual anchor cable fins 74 each of which is adapted to mount an anchor cable connected to an anchor (see Figure 1). The fins 74 are in a fixed relationship one to the other and to the body 72 of the mooring pole.

At the opposed end, there is provided a rotatable shaft 76 mounted in the body 72; the rotatable shaft 76 includes a coupling 78 adapted to receive and fix thereto a primary cable (described hereinafter). The coupling 78 includes a pivot point 80 permitting the coupling to rotate/move as desired depending on current conditions. As will be seen from Figure 1, the mooring unit is adapted to be positioned beneath the surface of the sea; the coupling 78 includes a primary floating cable 82 extending to either or both of the feed storage unit and the deflector 20.
Figure 7 illustrates a modified version of the mooring pole where similar reference numerals describing similar parts are employed. In this case, the coupling 78a can be of a type which is adapted to receive and block a primary cable; as illustrated in Figure 7, the coupling 78a may be mounted in a housing 79 fixedly secured to the body 72.

A plurality of anchors 84 are individually attached one each to the anchor fins via appropriate cables 86 with the anchors 84 being spread out generally in a circular arrangement. In this manner, the complete unit can be positioned in a desired location in the ocean.

Referring now to Figures 8 to 11, there is also illustrated a preferred embodiment of the invention where each of the fish cages includes a fish feeding dispenser (100) capable of dispensing a slurry within a predetermined area for each of the fish cages. More particularly, a central housing (110) which is normally oriented in a vertical condition when in use. The housing (110) forms a hollow feeding chamber extending from an inlet indicated generally by reference numeral (112) and an outlet (116) at the top of the unit, described hereinafter in greater detail. The chamber can be of varying dimensions both lengthwise and widthwise depending on the area to be served by the unit; typically the diameter may range from 1 inch to 8-10 inches.

The inlet end, in the embodiment illustrated, includes a generally "U-shaped" lower end portion but the inlet may in fact be vertical or have other orientations depending on the nature of the aqueous body in which the body is to be located. In the arrangement shown, the inlet includes a threaded or similar end portion (118) adapted to be coupled to a source of a slurry feed (not shown). In order to achieve the desired flow characteristics for the slurry feed, the inlet desirably has rounded corners (120a) and (120b).

Figure 8 illustrates the feed dispenser (100) including a plurality (in this case 6 equally spaced apart) outlets emanating from a central portion, the outlets being indicated generally by reference numerals (116). Each outlet is designed to
disperse a similar amount of slurry feed; the outlets are connected together at the
top of the housing (100) through a generally "T-shaped" throat portion (122), which
splits off into the desired number of outlets (116). Again, the throat section is
preferably designed so as to provide smooth arcuate contours in order to aid in the
flow of the slurry in a desired manner. Each outlet can comprise an orifice which
may be of a varying geometric configuration ranging from generally circular openings
(in cross-section) to elongated openings; desirably the opening is dimensioned so as
to permit the feed in the slurry to be readily dispersed without any danger of blocking
the orifice, as well as to provide the necessary flow velocity. For an efficient
operation, the outlets will be designed so that feed is spread in a non-overlapping
pattern.

With respect to the number of discharge orifices, this will vary depending on the
nature of the feed to be dispersed, the area of the aqueous body, and other factors
which include desired flow velocities, etc. Distribution units of the present invention
desirably have a balanced outlet configuration meaning that the outlets are arranged
in a spaced apart manner whereby the force exerted by the dispensing of the slurry
feed from each of the nozzles is substantially neutral. Thus, for example, two or
more outlets can be employed, each arranged in a diametrically opposed
relationship; in the case of three outlets, preferably the geometric arrangement is
such that the outlets are in a generally triangular configuration. The number of
outlets can be as many as 12 or more for large slurry feeding distribution units or as
few as two in the case of smaller aqueous bodies or fish types.

It will be seen from the drawings and Figure 9 in particular that the orifices are most
desirably oriented such that the slurry feed flow from the orifices is generally
oriented upwardly. This is accomplished by the terminal ends of the orifices
indicated by reference numeral (124) be arcuately contoured; the angle between the
horizontal plane on the lower side of the outlets or nozzles (116) and the vertical
plane is such that the feed slurry is directed in an outwardly extending direction
above the horizontal plane. Again, for different types of feeds or for different sizes
of the distribution units of the present invention, the upwardly inclined discharge
portion will have an angle of between 2° to 50°, desirably 3° to 25°, above the horizontal plane. This angle will also vary depending on the positioning of the unit within the aqueous body of water and the amount of water intended to lie above the discharge outlets. The body of water in which the units reside can be correlated to the angle of discharge from the nozzles (116) so as to effect a “welling up” of the aqueous liquid outwardly from the nozzles but without the nozzles being at an angle which would cause the feed slurry to break through the water level.

Optionally, the unit may include buoyancy means indicated generally by reference numeral (126); this buoyancy unit can be designed to maintain the distribution unit at a desired level in an aqueous body. The buoyancy means may be any suitable component such as foam, air bladders, etc. The distribution unit or dispenser (100) may also include cover means (128) if desired such as a rigid cover of suitable material. If a cover is included, it preferably substantially covers all of the diameter of the unit, but not necessarily the apertures or outlets. The cover may be anchored to the feed conduits or outlets (116) by appropriate means such as by screws (130) or the like.

If desired, the central housing (100) of the unit may be provided with a protective screen or border (not shown) to prevent contact of the housing body by fish.

Referring to Figure 10, there is illustrated the distribution unit placed in a body of water, the surface of which is indicated by reference numeral (132). One optional feature illustrated in Figure 10 includes a provision of weight means (134) to position the distribution unit in a desired location in a body of aqueous liquid. The weight means (134) can take various forms – indeed, the unit may be anchored to the bottom using conventional weights such as cement blocks or in deeper water, the unit may be generally anchored in place by means of bottom anchors extending to the bottom of the sea.

Another optional feature of the distributor is illustrated in Figure 11; if desired, the unit can be designed to move about a body of water by providing directional control
means operating in conjunction with one of the discharge outlets for the slurry feed. In particular, a "U-shaped" channel or body (136) is mounted to the top surface (128) of the apparatus and the channel (136) is provided with a terminal end portion (138) angularly disposed with respect to its main body. The disposition of the terminal end portion is such that it is designed to receive and displace the flow of slurry in a downwardly and rearwardly extending orientation from one of the slurry channels. In this way, the unit may move about the surface of a body of liquid so as to permit a greater area to be fed using a single apparatus. The degree of movement can be controlled by the length of any tethering device attached to the diffuser and the degree of movement permitted by the tethering device.

In another optional embodiment of the present invention, the distributor may include remote control means operatively mounted in or on the unit to permit the unit to be displaced/moved to different locations. In such a case, the unit need not be provided with anchoring or tethering means; such remote control means are well known for different purposes and can be pre-programmed to cover pre-defined and predetermined patterns. Thus, a suitable motor can be provided, connected to a drive means for propelling the unit.

For use in climates where ice conditions may be of a concern, the unit can be provided with suitable anti-icing features such as electrical heaters built into the apparatus which are adapted to be turned on when icing conditions are encountered. The distributor can be provided with battery means which can be actuated remotely to effect de-icing when such conditions are encountered. To that end, remote telemetry can also be employed to indicate to a central control (such as a CPU) that icing conditions have been encountered and either the de-icing is remotely activated by manual or automated means.

The distributor of the present invention can be made from various types of materials. Depending on the environment in which the apparatus is intended to be located, suitable materials include metals of various types, plastics, etc.
The unitary fish farming system of the present invention is further capable of being moved from its off-shore position to safe harbour simply by towing the system as a unit in the event of serious inclement weather or imminent threat to the site which may otherwise damage the fish in the containers.

As described in detail herein above, the off-shore unitary fish farming system of the present invention, provides an efficient and economical way of farming large quantities of fish at an off-shore site.
CLAIMS:

1. A containment system for feeding fish in an environmentally exposed aquatic site, comprising:
   - a storage unit for fish feed having a single point connection and being capable of being anchored to a sea bed;
   - a current and debris deflector connected to said single point connection for dampening current and waves and divert debris;
   - a plurality of cages sequentially arranged in parallel and axially extending from said current deflector, said cages displaced from one another by flexible positioning means enabling said cages to move relative to one another while remaining as a unit and without contacting one another, said cages being adapted to have an upper portion float above a body.

2. An off-shore unitary fish farming apparatus, comprising:
   - a plurality of fish containers aligned sequentially having attachment means for flexibly connecting said containers to maintain said containers in a predetermined relationship to one another;
   - a dampening means attached to at least one of said containers to reduce current and wave effects on said containers,
   - a fish feed tank for holding, mixing and distribution of fish feed slurry to each of said plurality of fish containers, said fish tank having a securing means for attaching said dampening means to said tank; and,
   - anchor means to anchor said apparatus to an aquatic floor, said anchor means allowing radial movement of said tank around an anchor position.

3. The apparatus according to claim 2, wherein said fish feed tank is remotely actuated.

4. The apparatus according to claim 2 or 3, wherein said fish feed tank further includes a crane.
5. The apparatus according to any one of claims 2 to 4, wherein said fish feed tank is structured to have a low centre of gravity for stabilizing said tank.

6. The apparatus according to any one of claims 2 to 5, wherein said fish feed tank acts as a stabilizer for said apparatus.

7. The apparatus according to any one of claims 2 to 6, wherein said fish feed tank further includes securing means for securing said current deflector to said fish feed tank unit.

8. The apparatus according to any one of claims 2 to 7, wherein said fish feed tank further includes storage means and pumping means for pumping slurry feed to said plurality of cages.

9. A fish feeding system, comprising:
   - a plurality of fish containers having flexible positioning means connecting said containers and maintaining said containers in a predetermined relationship, said containers having an upper portion, said upper portion capable of floating above the water;
   - means for maintaining said containers in alignment in a row;
   - connection means between adjacent containers;
   - dampening means attached to at least one of said containers to reduce current and wave effects on said wave containers.

10. The fish feeding system of claim 9, wherein there is further provided means connecting a leading one of said cages to a deflector.

11. The fish feeding system of claim 9 or 10, wherein said connection means comprises means for connecting and positioning each cage in a row.

12. The fish feeding system of any one of claims 9 to 11, wherein said system further includes an angled deflector, said angled deflector including a pair of
arms extending in a V-shaped and which includes a support means extending between said V-shaped arms.

13. The fish feeding system of any one of claims 9 to 12, wherein said containers further include connection means adapted for connection to a feeding unit.

14. The fish feeding system of any one of claims 9 to 13, wherein said upper portion of said containers further includes a flotation means.

15. The fish feeding system of any one of claims 9 to 14, wherein said containers comprise an open mesh material.

16. A mooring pole device suitable for connecting a plurality of anchor means and for connecting a guy cable, comprising:
- an elongate substantially non-flexible body having one end including a plurality of securing means, each of said plurality of securing means adapted to provide an anchor connection, and an opposed end having connection means for a guy cable, said connection means being rotatable relative to said elongate member preventing wear and entanglement of said anchor connections.

17. The fish feeding system of claim 2 or 9, wherein each of said fish containers includes means for dispensing feed into said container.

18. The system of claim 17, wherein said dispensing means comprises means for distributing feed within each container below the surface of an aqueous body in which said containers are positioned.

19. The system of claim 2 or 9, wherein each of said containers includes an apparatus for dispensing a slurry feed suitable for fish feeding under the surface of an aqueous body, said apparatus comprising:
- a housing having a feed inlet and a radial feed dispensing means;
means for providing a slurry containing a feed product to said feed inlet means in said housing; and
said radial feed dispensing means comprising a plurality of spaced-apart slurry dispensing outlets therein for dispensing slurry radially and outwardly from said housing under the surface of said aqueous body.

20. The apparatus as defined in claim 19, wherein said housing comprises an elongated chamber having upper and lower portions, with said radial feed dispensing means being at said upper portion and being adapted to radially dispense a plurality of slurry streams containing said feed about the peripheral area extending outwardly from the upper portion of said housing.

21. The apparatus as defined in claim 20, wherein said feed dispensing outlets comprise a plurality of spaced-apart channels extending outwardly from a central portion of said housing, said channels being balanced about the periphery of said housing with opposed ones of said channels balancing channels on an opposed side of said housing.

22. The apparatus as defined in claim 21, wherein said channels comprise a trough-shaped channel in a dispensing member, said channels having an outlet section at one end thereof, and means for deflecting feed projected from the outlet section in a downwardly extending direction.

23. The apparatus as defined in any one of claims 22, said apparatus including a directional thruster to permit said housing to rotate about a central axis.

24. The apparatus as defined in claim 23, wherein said directional thruster includes thrust diversion means adapted to permit said apparatus to change movement direction.

25. The apparatus as defined in claim 24, wherein there are provided an equal number of dispensing outlets arranged in a circumferential manner in a
spaced-apart equidistant configuration.

26. The apparatus as defined in any one of claim 25, wherein said apparatus includes a flotation element.

27. The apparatus as defined in any one of claim 26, wherein said apparatus includes ballast adapted to stabilize said apparatus when dispensing slurry feed.