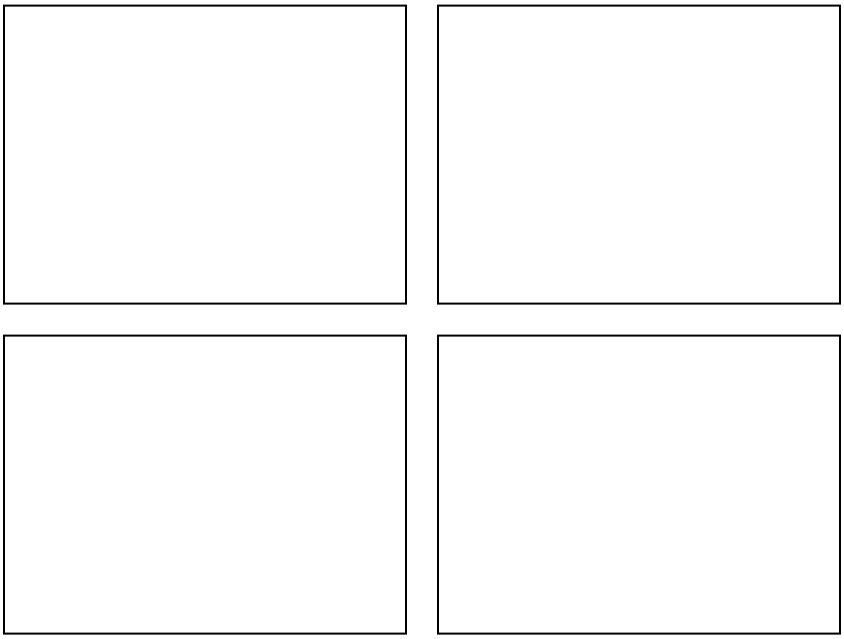
FIBREGLASS PRODUCTS FOR AQUACULTURE APPLICATION



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GENERAL INFORMATION

Our molded tanks are developed for corrosive applications where light weight, free maintenance, corrosion resistant and Eco-friendly tank are required.

Quality Manufactured Product

Our factory is an ISO 9001:2015 certified company, The tanks are manufactured complying with BS 4994 , BS EN 13280 standards . Every tank is subjected to a number of quality assurance inspections Complete traceability of resin batches and the glass is maintained and can be provided as needed . Chemical resistant tests and hydrostatic water tests are routinely performed .

Contact Molded Tank

Open Molding is the most flexible of all composite fabrication processes. Part size and design options are virtually limitless for open molded parts. Typically, the open molding process is used for very complex parts that cannot be produced in more automated processes, or for parts that are produced in low volumes and cannot justify the higher mold costs of the automated processes.

The open mold process frequently utilizes a surface coating called a gelcoat or topcoat. The gelcoat is applied directly to the mold using a spray process or manual which results in a high quality durable surface. After the coating is applied, the back-up reinforcement and binder resin is applied, either by spray or manual application. Entrapped air is removed from the resin/reinforcement mixtures, and additional layers of laminate are added to build thickness and strength as desired

Vacuum infused modular Tank

For Large tanks of dia 10.0m and above , using Vacuum infusion to manufacture GRP/FRP aquaculture tanks is a major step up in structural quality .

Vacuum infusion offers massive performance advantages for commercial fish farming infrastructure :

- Zero osmosis Risk (Void Free laminate) : handlay-up typically results in 5-10 % air voids, which can catch water , trigger osmotic blistering , and harbor bacteria . Vacuum infusion drops voids to less than 1 % .
- High Glass to Resin Ratio : infusion yields a much tighter laminate 60-65 % glass to 35-40% resin by Weight .This drastically increases structural tensile strength , allowing to design thinner , lighter walls that can handle hydrostatic loads

IMPORTANT FEATURES

1-Corrosion Resistant :

Resistant to sea water from -40 ^{o} F to 300 ^{o} F . Unlike Steel or concrete, GRP does not require coating . The corrosion resistance is achieved by the choice of the gelcoat /Polyester resin and is enhanced by adding chemical resistant surface veil to the inner Liner in contact with sea water .

2- Light weight :

GRP weighs 1/3 the weight of steel , resulting in lower installations cost.

3-Expansion and Contraction :

Concrete expands and contracts causing corrosion and cracks over time. Fiberglass does not expand or contract.

4- Maintenance free : GRP does not require any blasting or coating .

5- Low thermal Conductivity : Very low compared to steel (240 times less), excellent for chilled water application . Hence the cost of insulation for GRP is much less than for the steel.

6- Bacteria and Algae resistance :

Fiberglass has a smooth interior finish and is not porous making it a perfect environment to combat bacteria accumulation and algae from forming.
The smooth, fish-friendly surface eliminates fin and scale damage, which can increase susceptibility to infection. Additionally, morts and solids move quickly to the drains, which helps maintain optimal water quality.

7-Microbial Induced Corrosion (MIC) :

Fiberglass is resistant to hydrogen sulfide which creates sulfuric acid, a common cause of deterioration in concrete.

8- **Installation time :**

Fiberglass tanks can be transported on a single truck and are delivered to the site . As a finished product making installation easier and faster.

9- Water Quality : Genuine food grade material , suitable for aquaculture application

AREA OF APPLICATIONS

Our Aquaculture GFRP Tanks systems are designed to accommodate a wide variety of applications , such as: Fish Hatcheries .

- Fish Farm land base.
- Fish Hatcheries .
- Government Marine Research institute .
- Laboratory at University.
- Public Aquarium & Underwater Zoo .
- Theme & Water parks

INTRODUCTION TO HATCHERY

BIOLOGY & LIFE HISTORY :

1-1 SEABREAM GILTHEAD
The gilthead Seabream *Sparus Aurata* is a perciform fish , belonging to the family Sparidae and to the genus Sparus. The breeding season range from October to December. The Gilthead seabream is a functional male in the first two years and at sizes over 30 cm become females. After spawning , the eggs , which are spherical and transparent , have a diameter of slightly less than one mm and present a single large oil droplet .

1-2 SEABREAM GILTHEAD
The sea bass, Dicentrarchus labrax , is a Perciform fish , belonging to the Moronidae family and to the genus Dicentrarchus. Seabass is a predator consuming small fish and a large variety of invertebrates.
In seabass sexes ae separate : the female shows a deeper body with a longer pointed head and greater pre-dorsal and pre-anal lengths .There is only one breeding distribution season per year , which takes place in winter (December to March) in the Mediterranean sea. For Hatchery purpose , spent females have to be replaced by new breeders as soon as new batches of eggs are required .

LIVE FOOD FOR MARINE FISH LARVAE

The timely and adequate supply of high quality Live food is still essential in the rearing of the early larval stages of many marine organisms .

1-3 ROTIFER USE IN AQUACULTURE

The rotifer is an excellent first food for larval stages of marine fish because of its small size, slow swimming speed , its habit of staying suspended in the water column , its high fertility rate , and its tolerance in salinity.

1-4 MICROALGAE

The production of large quantities of rotifers requires the production in parallel of marine microalgae on which rotifers feed. Microalgae , also called phytoplankton and algae , are unicellular eukaryotic planktonic algae . Their benefits in the larval rearing of marine fish are not longer limited to their original role to feed rotifers . The Fish larvae benefit indirectly from the presence of selected phytoplankton species in their tanks during the first rearing days , as they work both as immunological stimulus and conditioner of water quality , limiting the development of bacteria .

1-5 ARTEMIA USE IN AQUACULTURE

As the mouth size of marine fish larvae increases with age , rotifers are gradually replaced by the larger freshly hatched nauplii of the brine shrimp *Artemia salina* . The most important biological characteristic of Artemia is that it produces resistant Cysts , containing Embryos in diapause (dormant stage).The function of Cysts is to protect the embryos against dehydration and excessively high temperature and salinity values.

BROODSTOCK :

Any hatchery should secure a reliable and sufficient supply of good quality fish eggs.
Most Mediterranean hatcheries have established their own broodstock units , where breeders of different age groups of the species are kept under long terms stocking conditions.
The gilhead seabream , after undergoing sex reversal to become females , can lay 20,000 to 80,000 eggs every day for a period of up to four months. In seabass , as fecundity and egg quality improve after the first spawning , the optimal age for female parent fish is between 5 and 8 years , whereas for males this range is lowered to 2-4 years.

LARVAL REARING SYSTEM :

The first 4 to 6 weeks of the life of young seabass and gilthead seabream are spent in specific larval rearing unit of the hatchery. The most common equipment consists in a number of round fiberglass tanks of an individual capacity of 6 to 10 m3.

WEANING SYSTEM :

Weaning takes place in a dedicated section of the hatchery where the metamorphosed fish (45 days old) will grow until a size of 2-3 grams. At this stage they are named fingerlings or juveniles.
The layout of the weaning sector is equipped with a number of fiberglass large round or rectangular tanks with a capacity between 10 to 25 m3. The weaning stage represents a true intensive rearing system as the fish biomass becomes important and can reach up to 20 kg/m^3

FRY TRANSPORT :

When the size of 2 to 5 g is reached, weaned fry leaves the hatchery to be stocked, either in pre-growing fiberglass tanks or floating cages. When the fish are sold or when the on-growing facilities of the farm are far from the hatchery; the use of trucks is the main way of transporting live fish. The trucks are equipped with several fiberglass insulated rectangular closed tanks of capacity ranging from 1600 to 2400 l with an oxygen supply system .

GRP Artemia / Rotifier Tanks:

The early life stages of Seabass and gilthead seabream are zooplankton-feeders, i,e the prey on small free living planktonic animals . The successful rearing still depends on an adequate supply of high-quality live feeds, usually in the form of rotifers (fed on unicellar algae) and brine shrimp (*Artemia spp*).

In Mediterranean hatcheries, the circular fiberglass tanks are used for Artemia /Rotifer culture.
They are made of reinforced fiberglass with a smooth, glossy NPG- gelcoat interior and they have a volume ranging from 1 to 10 m^3. As water circulation and particles sedimentation are important in rotifer culture, a widely adopted design is the round tank with conical bottom.

GRP Egg Incubation Tanks:

Our fiberglass round tanks with a conical bottom and a 100 to 250 l capacity represent the most common technical solution adopted by Hatcheries. The Cylindro-Conical Shape gives a good water circulation pattern, provided that a central aeration source is placed near the tip of the conical bottom , and a better separation of not viable eggs and hatching debris. The inner surface is smooth to prevent any damage to eggs and newly hatched larvae.

GRP Live Food Holding Tank (Insulated):

Our fiberglass round tanks are thermally insulated with a conical bottom represent the most common technical solution adopted by Hatcheries.

GRP Culture Circular Tanks:

The Fiberglass circular fish culture tanks come in various sizes, in a sectional or one-piece design, and are available with or without pedestals. These tanks have a reinforced top lip and the bottom is designed in conical shape.
The in smooth, fish-friendly internal gel coated surface eliminates fin and scale damage, which can increase susceptibility to infection. The walls are slightly tapered to allow nesting together for economical shipping.

GRP Culture Rectangular Tanks:

The Fiberglass rectangular fish culture tanks come in various sizes, in one-piece design, and are available with or without pedestals. These tanks have a reinforced top lip and the bottom is designed with a slope toward the drain.
The in smooth, fish-friendly internal gel coated surface eliminates fin and scale damage, which can increase susceptibility to infection. The walls are slightly tapered to allow nesting together for economical shipping.

GRP Live fish transport Tanks :

The basin of live fish transport tank are made from fiberglass insulated with 50 mm polyurethane And S.steel internal reinforcement. The internal surface is a glossy NPG gelcoat smooth surface with no sharp edges at internal corners. The outlet can be made through a large ball valve or through a sealed

removable gate . Additional accessories are available such as outlet chutes. The upper lid can be flat or with air chamber. The top surface are anti-slip type which makes it possible to stand on the roof for servicing them.

GRP Oxygen Cone:

Our oxygen cones are used for mixing oxygen in the water. The shape makes the saturation efficiency very high , up to 95% . Water and oxygen enter at the top of the cone at relatively high speed. The stream of water pushes the oxygen bubbles down until they completely dissolve.

Design pressure : 1.5 , 2 and 4 bar G
Material : Glass fiber
Saturation efficiency : 95 %

25 mg/liter of dissolved oxygen can be reached with 1 bar G water pressure. If higher water pressure is used , water gets supersaturated with oxygen and it should be mixed with main stream to prevent fish intoxication with oxygen .

Model	Max water Flow rate (l/min)	Dissolved oxygen at 15 o C (kg/h)	
		Water pressure 1 bar G	Water pressure 1.5 bar G
LG-OC 30	500	0.8	1.2
LG-OC 60	1000	1.6	2.4
LG-OC 90	1500	2.5	3.6
LG-OC 110	1833	3.1	4.4
LG-OC 140	2333	3.8	5.6

Model	**Weight**	**Dimensions (cm)**			**Flange std**
	Kgs	**A**	**B**	**C**	
LG-OC 30	27	172	60	36	DN 100
LG-OC 60	52	219	80	42	DN 100
LG-OC 90	57	220	90	47	DN 125

LG-OC 110	61	270	100	49	DN 125
LG-OC 140	61	270	100	49	DN 125

GRP fish sorting cradle:

The fish sorting cradle is used for manual sorting the large fish from smaller fish from 8 to 110 gr.
The cradle is equipped with a range of PVC pipes with slot varying from 1.5 mm to 16 mm.
We provide two types of GRP sorting cradle:

Type A Standard

Photo #

Type B (floating type)

photo #

Model	**Width mm**	**Length mm**	**Height mm**	**PVC Grid slot size**
LG-CSM –G1.5	524	630	395	1.5 x 135
LG-CSM –G2.0	524	630	395	2.0 x 135
LG-CSM –G2.5	524	630	395	2.5 x 135
LG-CSM –G3.0	524	630	395	3.0 x 135
LG-CSM –G3.5	524	630	395	3.5 x 135
LG-CSM –G4.0	524	630	395	4.0 x 135
LG-CSM –G5.0	524	630	395	5.0 x 135
LG-CSM –G6.0	524	630	395	6.0 x 135

INTRODUCTION TO LAND BASE FARM WITH WATER RECYCLING

Introduction

In conventional aquaculture systems , whether land or sea based , the living conditions for farmed fish depend on flow-through of clean , unused water from freshwater sources or coastal currents. Flow-through and open culture has many benefits ,but also well-known drawbacks such their dependence on ample supply of high quality water (fresh or marine).
External variation in seasons and temperatures have major influences . There is a risk for colonization by pathogens and parasites. Hence , the open culture systems (ponds and cages) leave open direct routes for spread of diseases and medicinal residues , as well as escape of cultured fish , to the environment .
A traditional flow through system for trout will typically use around 30 m3 of fresh water per kilo of fish produced per year. As an example, on a fish farm producing 500 tons of fish per year, the use of new water in the examples given will be 1 712 m3 /h.
New farms with super intensive farming systems with RAS system installed inside a closed insulated building using as little as 300 litres of new water per kilo of fish produced per year, which is equivalent to 17.12 m3/hr for the example above.

RAS (Recycling Aquaculture Systems)

The Effluent water leaving the rearing tanks is treated and refreshed before being returned to the tanks, thereby radically reducing external water requirements.

The set-up of RAS Systems must address the following:

1- Control of intake water
2- Tight biosafety controls to prevent proliferation of disease
3- Continuous removal of dead fish and dissolved solids
4- Removal of nitrogen wasters (bio-filtration)
5- Management of dissolved gases (oxygen, CO2, dissolved Nitrogen etc)
6- Management of PH , alkalinity and temp
7- Monitoring and control systems.

The advantages

- Farming in a controlled environment
- Flexibility in choosing inland locations for fish farming,
- Flexibility in choosing species for farming

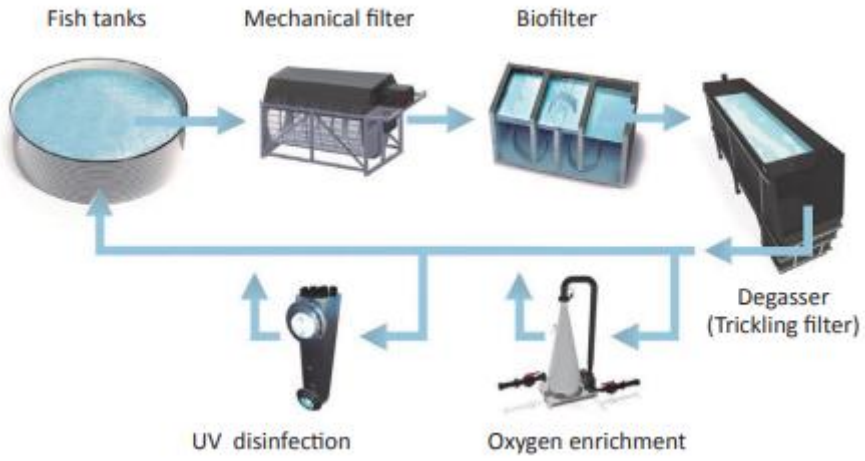
- Farming with high fish density
- Water conservation, there is no complete water exchange, rather 5 % to 10 % W.E per day
- control and utilization of waste and nutrients for energy, aquaponics and feed production

RAS SYSTEM EQUIPMENTS:

All modern RAS systems generally have the following components;

- Pump
- GFRP Bio-filter
- Solids collection systems (a rotating drum filter)
- A foam fractionation unit (also known as a protein skimmer or dissolved air floatation device)
- GFRP Carbon dioxide degasser
- Nitrate filter
- Sterilization points (usually UV sterilization)
- Tank drainage system that separates wastes from main outflows
- Temperature control (heat pump or evaporative cooling)
- Heat exchange of effluent waters
- Oxygen injection system
- A pH control and alkalinity dosing system

In a recirculation system it is necessary to treat the water continuously to remove the waste products excreted by the fish, and to add oxygen to keep the fish alive and well. A recirculation system is in fact quite simple. From the outlet of the fish tanks the water flows to a mechanical filter and further on to a biological filter before it is aerated and stripped of carbon dioxide and returned to the fish tanks. This is the basic principle of recirculation. Several other facilities can be added, such as oxygenation with pure oxygen, ultraviolet light or ozone disinfection, automatic pH regulation, heat exchanging, denitrification, etc. depending on the exact requirements.



GFRP Equipment for RAS System

GFRP FISH TANKS:

The environment in the fish rearing tank must meet the needs of the fish, both in respect of water quality and tank design. Choosing the right tank design, such as size and shape, water depth, self-cleaning ability, etc. can have a considerable impact on the performance of the species reared. Tank outlets must be constructed for optimal removal of waste particles and fitted with screens with suitable mesh sizes. Also, it must be easy to collect dead fish during the daily work routines. Tanks are often fitted with sensors for water level, oxygen content and temperature for having complete control of the farm. It should also be considered to install diffusers for supplying oxygen directly into each tank in case of an emergency situation

GFRP CIRCULAR TANK:

In a circular tank, or in a square tank with cut corners, the water moves in a circular pattern making the whole water column of the tank move around the center. The organic particles have a relatively short residence time of a few minutes, depending on tank size, due to this hydraulic pattern that gives a self-cleaning effect. A vertical inlet with horizontal adjustment is an efficient way of controlling the current in such tanks.

GFRP RACEWAY TANK:

In a raceway the hydraulics have no positive effect on the removal of the particles. On the other hand, if a fish tank is stocked efficiently with fish, the self-cleaning effect of the tank design will depend more on

the fish activity than on the tank design. The inclination of the tank bottom has little or no influence on the self-cleaning effect, but it will make complete draining easier when the tank is emptied. In a raceway, however, the oxygen content will always be higher at the inlet and lower at the outlet, which also gives a different environment depending on where each fish is swimming. The oxygen probe for measuring the oxygen content of the water should always be placed in the area with the lowest oxygen content, which is near the outlet

GFRP D –ENDED TANK:

A hybrid tank type between the circular tank and the raceway called a "D-ended raceway" also combines the self-cleaning effect of the circular tank with the efficient space utilization of the raceway

GRP Tank properties	Circular tank	D-ended raceway tank	Raceway tank
Self-cleaning effect	Very good	Good	Average
Low residence time of particles	Very good	Good	Average
Oxygen control	Very good	Very Good	Good
Space utilization	Poor	Good	Very good

GFRP BIO-FILTER TANKS:

The fish excrete ammonia (NH_3) through the gills and urea via the urine, both of which dissolve in the water. Urea also forms ammonia, which can be harmful to fish at low concentrations. In RAS, biological filters are used to convert ammonia in a two-step process into relatively harmless nitrate (NO_3). In the first step of nitrification, ammonia-oxidizing bacteria convert the ammonia into nitrite (NO_2^-). In the second step, this NO_2^- is converted by nitrite oxidizing bacteria into nitrate the end product of nitrification reaction.
The oxidation of reduced nitrogen (NH_3) by bacteria is a natural process known as nitrification.
Once established, biofiltration can continuously provide necessary nitrification for a recirculation unit without much maintenance, if the four requirements above are provided.
Nitrification requires four things:

1) ammonia, of course, which is the "food" that is oxidized,
2) oxygen, which the bacteria combine with ammonia to release energy for their growth,

3) substrate for the bacteria to adhere to in order to maintain a sufficient biomass,
4) a pH greater than 7, which the bacteria require

Of the four requirements of nitrification, fish supply the ammonia, of course, and the aqua culturist monitors pH and adds sodium bicarbonate as necessary. The design of the biofilter provides the surface area for colonization and it may help supply the oxygen, as well. Biofilters must also be self-cleaning, that is they must not clog as the bacteria proliferate. Surface area is created in all biofilters with inert media. As for oxygen, there are two classes of biofilter. One has a design that promotes the diffusion of oxygen from the air. Rotating biological contactors (RBC's) and trickle filters fall into this group. These elevate the wet media into the air in some way so the vast surface area for bacteria is also used for diffusion of oxygen. In the other group, the media stays submerged and all oxygen for nitrification must come from the water, increasing the demand on the system's gas exchange mechanism. Bead filters and suspended bed filters are examples

GFRP DEGASSIFIERS TANKS:

When fish consume oxygen, CO_2 is released in the water. To high carbon dioxide levels can negatively influence the fish growth or even be lethal. Therefore, it is important that CO_2 is efficiently removed from the culture water.

GFRP WALKWAYS & STAIRCASES:

Fiberglass walkways are increasingly used as a durable alternative to conventional steel. There is a notable increase in the demand for GRP products for aquaculture environments. A GRP walkway is a completely adjustable modular system that is assembled to meet their specific needs of an aqua culturist.

A GRP walkway usually consists of the following components:

- GRP (beams) profiles;
- GRP (columns) profiles;
- GRP mini mesh grating;
- GRP handrails.

The advantages of GRP walkways

- Corrosion-resistant;
- Fire-retardant;
- Durable;

- Anti-slip
- Lightweight;
- Maintenance-free;
- Not electrically conductive;
- Easy & quick installation
- Light weight (1/3 of steel)

Standards

GRP walkways are made of isophthalic polyester (ISO-FR) profiles and satisfy the following standards:

- EN-ISO 14122-3;
- Anti-slip is guaranteed by the concave surface of the gratings ASTM E303
- ASTM E-84

GFRP CABLE TRAYS & PIPES TRAYS:

It provides a non-magnetic, non-conductive and corrosive free lightweight alternative to metallic systems whilst offering superior strength to weight ratio. GRP is maintenance free, requires no periodic and meets regulatory requirements for flame rating, propagation and self-extinguishing properties.

Materials conforms to international standards of NEMA FG1, BS 476 Part 6, ASTM E-184, ASTM-D635, IEC 60754-1

Advantages of FRP / GRP Perforated Cable Trays & Pipe Trays

- Corrosion resistance to aquaculture
- Light weight so easy to move and place
- Excellent electrical insulation properties
- Very high strength to weight ratio
- No earthing required
- Very low thermal conductivity
- U.V resistant
- Impact resistant – returns to original position without any permanent deflection or distortion
- Non-toxic
- Easy to install
- Long life cycle

GFRP LIGHT TRUSS BRIDGE

The use of GRP Light truss Bridges over large concrete aquaculture tanks is an excellent choice.

Aquaculture environments are notoriously harsh – highly humid , often saline and sometimes chemical heavy which make traditional steel or wood prone to rapid degradation. GRP solves these durability issues while remaining lightweight enough to span large distances without requiring heavy expensive structural supports.

GRP has a very high strength to weight ratio .It Weighs about 75% less than steel and 30 % less than Aluminum .

- Low bearing load : it places minimal dead -load stress on the walls of the concrete tanks
- No heavy Cranes : because the truss is incredibly light , segments can often be pre-assembled off site and lifted into plate using light truck cranes or manual rigging reducing installation cost