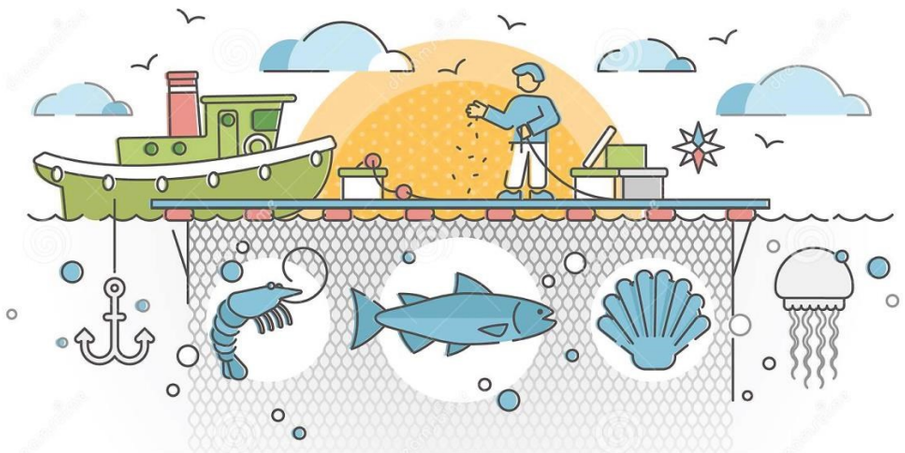

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Applied Biology

Sampath Biology

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10.1 Aquaculture

Unit 10 Applied Biology

10.1.0 : Uses biological concepts and principles to promote the living standards

10.1.1 : Investigates ornamental fish culture systems

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11. Which of the flowing correct regarding disease and causative organism.
(1) Fin rot and Gill rot - Gill flukes (2) Haemorrhagic septicemia - Fungi
(3) Columnaris - Bacteria (4) Trichodinosis - Bacteria
(5) Gill and skin infestation - Bacteria

12. Which of the following statements are incorrect regarding benefits and damages of ornamental fish farming.
(1) Species conservation, and production of species that are difficult to obtain from the wild.
(2) The golden arrowana, and tiger barb (*Puntius tetrazona*).
(3) Reintroduced to habitats in which they have been eliminated.
(4) Fish and aquatic plants that are accidentally escaped to natural environment could affect a wide range of native organisms from zooplankton to mammals.
(5) With imported live fish indigenous disease causing agents may also come in to a country.

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3. Which of the following fish is not grown as freshwater ornamental fish culture in Sri Lanka?
(1) Dandi (*Rasbora reticulate*) (2) Black molly *(Poecilia mexicana)* (3) Swordtail *(Xiphophorous helleri)*
(4) Platy *(Xiphophorous maculatus)* (5) Angelfish *(Pterophyllum scalarae)*

4. Which of the following is a general characteristics of species that could be cultured
(1) At least, feeding habits of early developmental stage of the species should be known.
(2) It should not reproduce in grow-out ponds/tanks. (3) Should not reach to sexual maturation.
(4) It should accept natural food and grow well.
(5) It should be an efficient converter of economical foodstuffs for growth and reproduction.

5. Which of the following is not a general characteristics of species that could be cultured
(1) If it is accidentally released to natural water bodies there should not be adverse environmental impacts.
(2) It should tolerate high population density & grow well .
(3) Having resistance to common diseases.
(4) It should satisfy consumers by the taste, nutritive value, texture of flesh and appearance
(5) Easy to provide nutritionally balanced diet for each development stage.

6. Which of the following fish is not grown as freshwater ornamental fish culture in Sri Lanka?
(1) Koi carp *(Cyprinus carpio)* (2) Discus *(Symhysodon discus)* (3) Siamese fighting fish *(Betta splendens)*
(4) Kissing gourami *(Helostoma temmincki)* (5) Thilapia

7. Which of the following is not true about ornamental fish culture.
(1) Ornamental fish keeping has been a hobby of humans for second only to the photography for centuries of years;
(2) Initially fish that had some colours were collected from wild and maintained in garden ponds for the joy of watching their aesthetic beauty.
(3) Ornamental fishes lure and draw a great attention worldwide through their attractive colouration, shapes and sizes of body and fins, swimming behaviours, ability to live under captive conditions and adaptability to live in little spaces.
(4) People keep fish in their homes for variety of reasons such as for decoration, children's education, enjoyment, relaxation of elderly or health affected individuals.
(5) Some fish are kept for prosperity and fortune of home occupants.

8. Which of the following is not an event done fortnightly:
(1) Introduce siphoning tube under the filter plate and suck out accumulated organic debris
(2) Rake or stir up gently the surface of the rooting medium (under-gravel filter medium)
(3) Scrape excess algal growth
(4) Allow debris to settle
(5) Replace the volume siphoned out with freshwater in which temperature, pH and hardness match with conditions of the water in the aquarium

9. Which of the statement is incorrect reason.
(1) Water turning into green frequently - receiving too much light.
(2) Growth of brown algae - insufficient illumination.
(3) Blue-green algal "mats" - high level of organic pollution.
(4) Blue-green algal "mats" - too much food are offered to fish
(5) Growth of brown algae - overstocking.

10. Which of the flowing statement is incorrect regarding common diseases of cultured, freshwater ornamental fish
(1) Ornamental fish kept in aquaria are susceptible to both infectious and non-infectious diseases.
(2) Invasion of fish tissues by a disease causing agent, multiplication of it in/on fish tissues and increasing its' population may lead to the development of an infectious disease in ornamental fish.
(3) Better management practices (BMPs) includes, maintenance of water quality, correct stocking density of compatible fish with compatible plants, correct feeding regime
(4) Keep the immunity of fish at a higher level and through correct bio-security measures such as quarantining new fish, plants and other aquarium décor.
(5) Fish white spot disease caused by a fungus.

10.1.1 : Investigates ornamental fish culture systems

Aquaculture

- Food and agriculture organization (FAO) defines aquaculture .....
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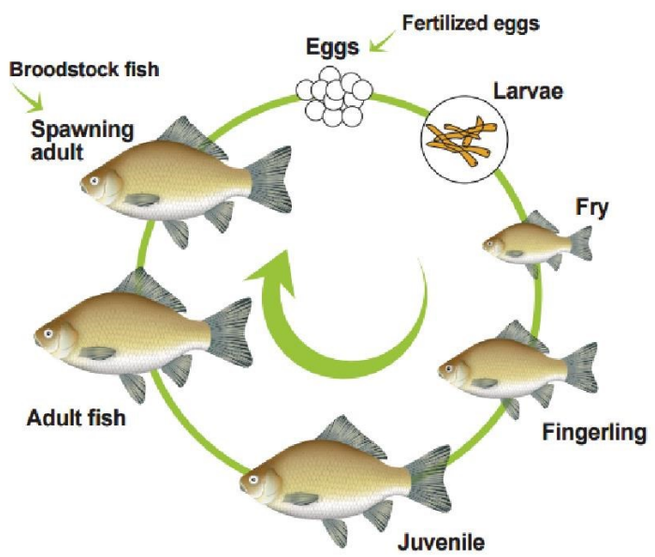
Importance of aquaculture

- Farming edible aquatic organisms is accepted as one of the best solutions for feeding the ever increasing human population.
- A healthy diet, high in protein is necessary to ensure that growing population does not succumb to sicknesses and diseases due to lack of essential nutrients.
- Harvests from wild sources of fish, crustaceans and other aquatic species cannot keep up with the demand presented by the growing human population.
- Trying to match the demand through commercial fishing would eventually result in over-fishing and the loss of those species entirely.
- It is accepted that while aquaculture is essential to meet the human demand for fish and fishery products, it also relieves the strain on wild species and allow them to continue to be a significant source of food for humans.

General characteristics of species that could be cultured



- Selected species should withstand the climate of the region in which it is cultured.
- It should grow well (should have a fast growth) in prevailing physical and chemical parameters of water in the area.
- It should be easy to breed (breeding techniques should be available) so that sufficient number of fertilized eggs/early fry could be obtained easily.

- Techniques of incubation of fertilized eggs and rearing techniques of hatchlings/early fly should be available so that the production of sufficient number of young organisms (seed) would be easy under culture conditions.
- If the eggs, larvae, fry, fingerlings, juveniles and adults of the species are hardy it is easier for the hatchery manager/ farmer (handling hardy species is easy).
- Food and feeding habits of each developmental stage of the species should be known (easy to provide nutritionally balanced diet for each developmental stage).
- It should not reproduce in grow-out ponds/tanks.
- If it reaches sexual maturation relatively late, it is advantageous.
- It should accept formulated food and grow well.
- It should be an efficient converter of economical foodstuffs.
- If it is accidentally released to natural water bodies there should not be adverse environmental impacts.
- It should tolerate high population density & grow well
- Having resistance to common diseases is advantageous.
- It should satisfy consumers by the taste, nutritive value, texture of flesh or appearance/body color/ color patterns.

Ornamental fish culture

- Ornamental fish keeping has been a hobby of humans for centuries of years; initially fish that had some colours were collected from wild and maintained in garden ponds for the joy of watching their aesthetic beauty.
- Ornamental fishes lure and draw a great attention worldwide through their attractive colouration, shapes and sizes of body and fins, swimming behaviours, ability to live under captive conditions and adaptability to live in little spaces.
- People keep fish in their homes for variety of reasons such as for decoration, children's education, enjoyment, relaxation of elderly or health affected individuals, prosperity and fortune of home occupants and to collect rare species and even to propagate them.
- Globally, ornamental fish keeping has emerged as one of the most popular hobbies being second only to the photography.

Species that are commonly used in freshwater ornamental fish culture in Sri Lanka

1. Guppy *(Poecilia reticulata)*
2. Black molly *(Poecilia mexicana)*
3. Swordtail *(Xiphophorous helleri)*
4. Platy *(Xiphophorous maculatus)*
5. Angelfish *(Pterophyllum scalarae)*
6. Discus *(Symhysodon discus)*
7. Siamese fighting fish *(Betta splendens)*
8. Kissing gourami *(Helostoma temmincki)*
9. Goldfish *(Carassius auratus)*
10. Koi carp *(Cyprinus carpio)* (Scientific names are not required to memorize)

	Disease	Group of disease causing agent
(a)	Bacterial fin rot and gill rot	
(b)	Heamorrhagic septcaemia	
(c)	Columnaris disease	
(d)	External mycosis	
(f)	Fish white spot disease.	
(g)	Trichodinosis	
(h)	Gill and skin infection	

(b) State environmental impacts of ornamental fish culture.

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MCQ

1. Which of the following is not an importance of aquaculture
   (1) For feeding the ever increasing human population.
   (2) A healthy diet, high in protein is necessary to ensure that growing population does not succumb to sicknesses and diseases due to lack of essential nutrients.
   (3) Harvests from wild sources of fish, crustaceans and other aquatic species cannot keep up with the demand presented by the growing human population.
   (4) Minimize effects of over-fishing and the loss of those species entirely.
   (5) Grow wild species and allow them to continue to be a significant source of food for humans.

2. Which of the following is not a general characteristics of species that could be cultured
   (1) Withstand the climate of the region in which it is cultured.
   (2) Should have a fast growth in prevailing physical and chemical parameters of water in the area.
   (3) It should be easy to breed so that sufficient number of fertilized eggs/early fry could be obtained easily.
   (4) Techniques of incubation of fertilized eggs and rearing techniques of hatchlings should be available.
   (5) Hardy eggs, larvae, fry, fingerlings, juveniles and fragile adults of the species.

(c) Growth of blue green algae

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7. State few better management practices (BMP)

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8. State what are bio security measures.

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9. State few benefits of ornamental fish culture

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10. State 2 hazards of ornamental fish culture.

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11. Select correct time period for following maintenance of home aquarium.

	Daily	Weekly	Fortnightly	Monthly
Provide nutritionally balanced diet				
Avoid feeding one day for adult fish.				
Scrape excess algae				
Siphon off debris with 20-25% aquarium water				
Introduce siphon tube under the filter plates and suck out accumulated organic matter				
Physical removal of algal mats followed by partial water exchange.				

12. (a) Common diseases of freshwater ornamental fish species given below. State the group of the disease causing agent.

Angel fish

Black molly

Discus

Fighter fish

Guppy

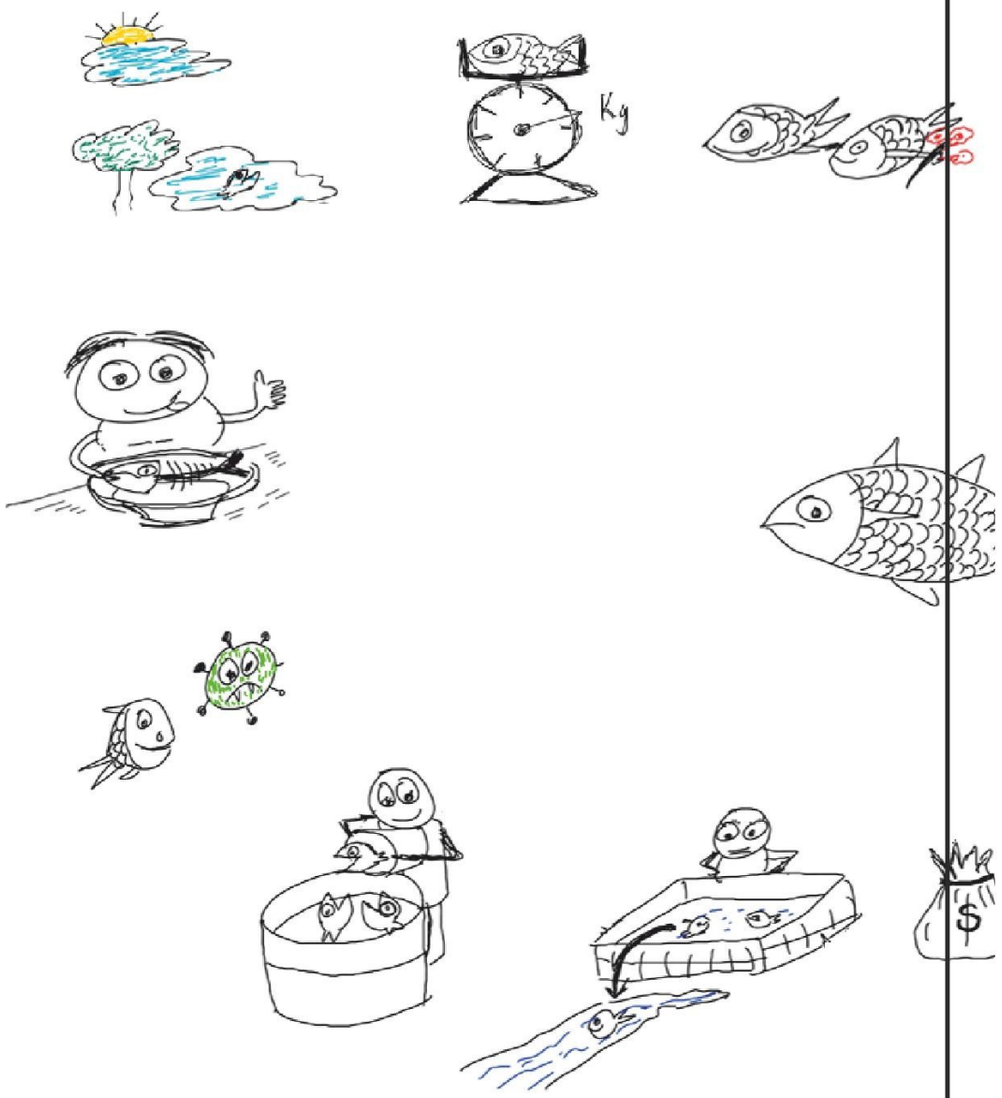
Koi carp fishes

Kissing Gourami

Platy fish

Sword tail

Gold fish



- In addition to the sale of fish to hobbyists, fish are also being reintroduced to habitats in which they have been eliminated.

2. Invasive ornamental fishes/aquatic plants that are accidentally escaped to natural environment could affect a wide range of native organisms from zooplankton to mammals across multiple levels of biological organizations ranging from the genome to the ecosystem.
3. With imported live fish non-indigenous disease causing agents may also come in to a country Haphazard use of broad-spectrum antibiotics and other chemicals as preventive/therapeutic treatments and release of treated water (containing those medications) in to the natural environment may cause antibiotic resistance/resistance to chemicals used on pathogenic microorganisms including human pathogenic bacteria.

Structured Essay

1. What is FAO

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2. Define aquaculture

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3. State general characters of species that could be cultured.

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4. What is an aquarium

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5. State 3 events that should done monthly to maintain home aquarium

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6. State the reasons for followings

   (a) Water turn to green frequently

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   (b) Growth of brown algae

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Common diseases of cultured, freshwater ornamental fish

- Ornamental fish kept in aquaria are susceptible to numerous diseases. Some of the diseases are infectious and some are non-infectious.

Infectious diseases

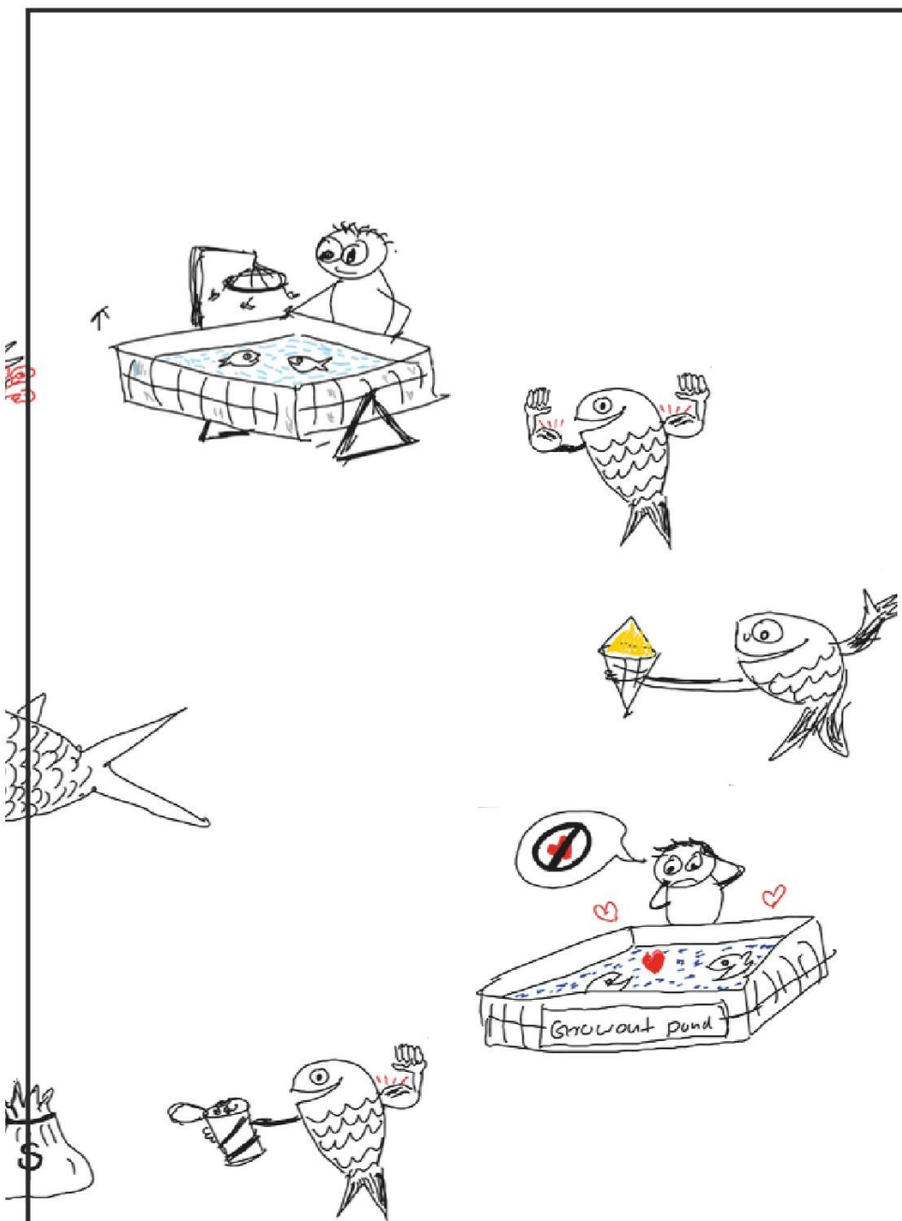
- Invasion of fish tissues by a disease causing agent (a pathogenic virus, bacterium, fungus, or an obligatory/ opportunistic parasite), multiplication of it in/on fish tissues and increasing its' population may lead to the development of an infectious disease in ornamental fish.
- However, many infectious diseases could avoided/prevented through better management practices (BMPs such as maintenance of water quality, correct stocking density of compatible fish with compatible plants, correct feeding regime) to keep the immunity of fish at a higher level and through correct bio-security measures (to prevent contamination by pathogens; Ex: quarantining new fish, plants and other aquarium décor).

Disease	Group of the disease causing agent
Bacterial fin rot and gill rot	Bacteria
Heamorrhagic septicaemia	Bacteria
Columnaris disease	Bacteria
External mycosis	Fungi
Fish white spot disease (ich disease)	A Unicellular external, obligatory parasites
Trichodinosis	A Unicellular, external, opportunistic parasite
Gill and skin infestation	Obligatory/oppourtunistic, gill flukes and skin flukes

Environmental impact of ornamental fish culture

1. Some impacts of ornamental fish culture are beneficial while some could be harmful.

- The first benefit of ornamental fish culture is species conservation, and production of species that are difficult to obtain from the wild.
- Breeding and rearing of approximately 90% of freshwater ornamental fish traded globally are done under captive conditions; there is some environmental benefit or elimination of environmental damage via those breeding programs.
- The golden arrowana, and tiger barb (*Puntius tetrazona*) are two species that have been conserved via ornamental fish production.



Aquarium

- An aquarium can be defined as a …… that is designed to hold water in which living organisms can be maintained over an …….. of time.
- Aquaria vary tremendously in size, shape and design ranging from a simple bottle containing some water (e.g. an empty jam bottle is used to keep a male Siamese fighting fish) to a multimillion Liters commercial exhibit tanks.

Maintenance of a home aquarium

- There are activities that should be carried out daily, weekly, fortnightly and monthly in order to maintain environmental conditions (water quality parameters) within the optimum ranges for the fish kept in an aquarium.
- Provision of correct nutrition and maintenance of water quality within optimum ranges contribute for the well-being and health management offish kept in an aquarium.

Daily:

1. Feed the fish with a nutritionally balanced diet following a correct feeding regime (suitable daily ration should be offered in 2 or 3 meals)
2. Check on the status of health while feeding and remove the affected individuals for treating in another tank/basin
3. Allowing fish to adapt for the changing intensity of light (to prevent unnecessary stress on fish), Switch on the light of the aquarium several minutes after the room lights have been on or after the day break -Switch off the light of the aquarium several minutes before the room lights are switched off or shortly before natural lights fades.

Weekly:

1. Fish should not be fed one day' per week (not applicable for brood fish, fry and fingerlings)

Fortnightly (in 2 weeks):

1. Switch off aeration
2. Rake or stir up gently the surface of the rooting medium (under-gravel filter medium)
3. Scrape excess algal growth
4. Allow debris to settle
5. Siphon off the debris along with 20% of the aquarium water
6. Replace the volume siphoned out with freshwater in which temperature, pH and hardness match with conditions of the water in the aquarium
7. Switch on aeration

Monthly:

1. Take out some water from the aquarium in to a basin /another tank/ bucket
2. Collect the fish carefully using a hand net and introduce them into the basin/ tank/bucket and arrange aeration to it.
3. Rinse rooting medium (under-gravel filter medium)
4. Remove the aeration tube from air lift, scrape off any deposit (algal or calcite) from the opening and clean/scrape off air diffuser stones
5. Introduce the siphoning tube under the filter plates and suck out the accumulated organic debris
6. Check the terminals of light source
7. Remove dead and dying leaves from plants
8. Prune, thin out and tidy the plants and replace poorly grown plants
9. Rearrange the filter plates and the filter medium
10. Arrange the aeration and fill the aquarium halfway with clean freshwater/aged aerated tap water.
11. Reintroduce the fish with the water and then fill the aquarium to the original level of water using aged clean freshwater

- No matter how much time and care is devoted things in an aquarium could go wrong from time to time.
- Equipment failure, excessive algal growth, poor water quality or occurrence of diseases could be the cause.
- Water turning into green frequently, green algae growing on plants on aquarium décor and on the side glasses of the aquarium indicate that the aquarium is receiving too much light.
- The reduction of intensity and/or duration of light followed by partial water exchange may prevent this situation.
- Growth of brown algae as brown encrustations on plants on aquarium décor and on the side glasses of the aquarium are indications of insufficient illumination.
- Blue-green algal "mats" on plants on aquarium décor and on the side glasses of the aquarium indicate a high level of organic pollution.
- Physical removal of algal mats followed by partial water exchange, a review of the maintenance routine with a view to prevent further accumulation of organic pollutants (whether too much food are offered to fish, inadequate filtration or aeration, overstocking, etc.) are required to correct the situation.