Water Sources in Fish-Culture

GROUND WATER SURFACE WATER (Streams, rivers, ponds, lakes, estuaries and Oceans)

TAP WATER (Public water supply).

Ground Water

Advantage;

* Generally considered the best source of water for fish culture.
* It is usually free of fish diseases organism.
* The temperature and composition are relativelly constant.

Disadvantage;

* The composition of ground water varies with the location depth of the well used to obtain the water.
* Much ground water is devoid of dissolved oxygen and must be aerated before use.

Surface Water

Advantage;

* Easy to obtain and economical.

Disadvantage;

* It is subject to contamination or pollution.
* The quality varies significantly with time.
* There is a potential for contamination of the system with wild fish, fish disease organisims and waterborn predators.

Tap Water

Advantage;

* It is usually free of fish diseases organism.

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* Easy to obtain

Disadvantage;

* The cost is high. It can be more suitable for closed systems.
* Chlorine is toxic to fish and must be removed before the water is used

Importance of Water Quality

Water quality is an expression that includes physical, chemical and biological factors that affect using water.

Fish are stressed when they are exposed to abnormal conditions except the optimal values.

If the stress is extreme and long, the adaptation time of the fish increases. As a result; growth retardation, impaired reproductive performance, impaired immune system or death can occur.

TEMPERATURE, OXYGEN, pH LEVEL, NITRITE, NITRATE AND AMMONIA LEVEL are the most important water quality criteria.

The importance of the water-quality criteria in fish-culture;

TEMPERATURE

Fish species can live different temperature
Depending on the water temperature;

- **Cold water fish: They live under 15 ˚C**
- **Warm water fish: They live between 15 to 24 ˚C**
- **Hot water fish: They live uper 25 ˚C.**

***10-degree increase in water temperature results in a two-fold increase in chemical and biological reactions of fish. The fish living at 30 degrees require about two times more O_2 than those living at 20 degrees. The low temperature suppresses the immune system.**

- **Trouts reach the market weight in 1 year at 15 ˚C, it can be reach the same weight in 2-3 years at 7 ˚C**

- **The fish can be adapted water temperature that gradually increased and reduced.**

OXYGEN

* The largest source of oxygen for water is atmospheric oxygen. In natural conditions, the oxygen concentration of water at 760 mm Hg pressure varies between 6-15 mg / L.

* If the height, temperature and salinity ratio increase, the amount of dissolved oxygen rate decreases.

* the oxygen remains between the layers during the filtration of water, Therefore, the groundwater contains little or no dissolved oxygen. (Inverse ratio)

* Photosynthesis is the most important oxygen source . The highest oxygen ratio is observed at sunset and the lowest at the sunrise.

NITRITE, NITRATE AND AMMONIA LEVEL

There are four primary sources of nitrogenous wastes: urea excreted by the fish, organic debris from dead and dying organisms, uneaten feed, and feces,

Ammonia oxidizing bacteria obtain their energy by catabolizing un-ionized ammonia to nitrite and include bacteria of the genera Nitrosomonas.

Nitrite oxidizing bacteria oxidize nitrite to nitrate, and include bacteria of the genera Nitrobacter and Nitrospira.

Nitrifying bacteria require oxygen to grow. Normally, these bacteria need 2-3 weeks to reach a sufficient number in a new aquarium.

Although nitrate is not as toxic as ammonia and nitrite, it causes poisoning over time in systems where water changes are not carried out for a long time and are not plant. Normally, nitrate is used by the plants for nutrition..

pH LEVEL

* * The pH of a water depends on the concentration of carbonate, bicarbonate and free carbon dioxide in it.

* Depending on photosynthesis, the concentration of carbon dioxide is affected in surface waters. The higher the CO2 ratio, the lower the pH.

* High pH (>9) waters are generally found in arid regions where sodium carbonate-rich soils are present, low pH (4<) waters are generally seen in coal mines or volcanic regions in streams and lakes.

* Aluminum, copper, zinc, cyanide and Hydrogen sulfide can easily dissolve in acidic water and cause poisoning.

HEALTH MANAGEMENT AND BIOSECURITY

•Effective **biosecurity** program is vital to maintaining healthy animals and to reducing the risk acquiring diseases in a facility.

The general features of an effective biosecurity program apply to all culture systems and include to major components: **external barriers, internal barriers and pathogen inactivating strategies.**

1) External Barriers:

- Using a specific-pathogen-free (SPF) warter source when possible.
- Never introducing fish from farms having older or less healthy fish.
- Restricting the movement of fish between farm sites of the same operator.
- If new fish must be introduced, using SPF fish and applying the quarantine procedures.
- Restricting access to the farm site (e.g., fencing the site, locking all doors, etc.)
- A pest manegment control program.

2) Internal Barriers:

- Physically separating each unit and keeping all units isolated from eachother.
- Having specific sanitation and personal hygiene protocols for each unit.
- Having specific sanitation protocols for movement of fish or materials between units (never allowing any transfers from unit X to unit Y)

3) Pathogen Inactivating Strategies:

Pathogens can be spread either by fish or as fomites (object other than the fish that are contaminated with the pathogen). Pathogens on fish (including eggs) are reduced or eliminated with anticeptics, while fomites are inactivated with disinfectants.

QUARANTINE:

- Quarantine is the isolation of a new population of fish prior to their placement within the established population.
- All material used for quarantine should only be used in the qurantine system. After use, everything should be treated with a high-level disinfectant.
- A minimum number of fish is often needed to reduce stress in the qurantine system. Feeding during quarantine is necessary, but fish placed in a new environment will often be anorectic. This behavioral anorexia must be differentiated from that caused by disease.
- It can be kept the temperature at the upper end of the fish species' optimum range in order to speed up parasite life cycle. However, high temperature is also more stressful for fish although this may also fascilitate the fish ''breeking'' with a subclinical infection, allowing its detection.

- Using of the prophylactic drug treatments during quarantine is suggested in many cases , such as for many wild-caught fish that might have a significant parasite burden. Most commonly used are broad-spectrum ectoparasiticidal treatments such as formalim, Cooper, or salt/freshwater exposure.

- The time needed for fish to remain in quarantine depends on the specific pathogen, its clinical course, and its life cycle. Times range from as little as 12 to 30 days. When screening for slow-growing pathogens such as mycobacteria, quarantine might require up to 90 days.

- It can be used an available diagnostic test for the detection of patogens during the quarantine period..

VACCINES:

- Vaccination of water animals against diseases is aimed to reduce mortality, and thus increase the economic efficiency.
- There are three routs to vaccinate fish; water-borne (Bathing fish in a vaccine solution), injection and oral).
- Oral vaccines are not highly protective.
- Fish should be fasted prior to vaccination.Fasting is often for 24 hours
- Only healthy fish should be vaccinated
- At least 21 days need to protecting after vaccination

BIOLOGICAL CONTROL:

• Biological control is the use of an organism to specifically prey upon, parasite, or otherwise reduce the level of an undesirable organism.

• The best well-documented fish that display this behavior are the wrasses (Labrids) The wrasse can eat over 1000 worms a day such as monogeneans.

• Today, Labroides, Elacatinus, Gobiosoma fish species and Periclimenes, Urocaridella, Stenopus and Lysmata shrimp species are used for this purpose.

AQUATIC ANIMAL DISEASES

- FISH CULTURE

TROUT CULTURE

-Rainbow trout of North American origin Oncorhynchus mykiss (Walbaum, 1792) is an important species for trout culture.

Oncorhynchus mykiss

Length of the adults is 35-40 cm.

There are many black, star-like spots on the skin

- There are 120-150 scales on the lateral line.

Research and Application Station in , Eskişehir-Çifteler .

In Natural Conditions

Eating Habits

crustacea

aquatic fly larvae

mollusc

Artificial Culturing conditions:

Water optimal conditions:

- must be always renewable, 10-17° C, >O_2 7 mg/lt, pH : 7-8

Water Supply:

•Aproximatelly, 1 liter/min water needs for growing 1000 frys or fingerlings.
•1 lt/min water needs for growing 1-1.5 kg. trout at 15^{0}C

Selecting and Developing a Brood Stock of Trout

- Male trout gives the best milt in 2-4 years old; female trout gives the best egg in 3-4 years old.

Females should not be used as breeder after 6 years of age

Brood stock trout should be fed With good quality feed

Artifical Fertilisation Methods

1) Wet fertilisation Method (-)

Fertilization rate is so low it is only 20 percent.

It is stripped eggs into a jar with water then milt and mixed.

2) Dry fertilisation Method (+)

Fertilization rate is so high it is 98-100 percent.

First eggs then milt are stripped into a dry bowl where they are gently mixed and adding of some water.

Incubation of eggs and Hatching and development of sack-fry

- The time from the fertilization of the eggs until withdrawing the egg sac is divided into three stage.

1.period : From egg fertilization to eyed egg stage (at 9°C, 22-25 days)
2. Period: From eyed egg stage to larvae hatching (7-15 days)
3. Period : From larvae hatching to withdrawing egg sac (15-21 days)

The actual time of hatching depends on water temperature and oxygen level of water
Hatching below 4 °C and above 15–18 °C - great losses.

RAINBOW TROUT needs 300-400 DAYDEGREES
Water temperature = 10 °C 300-400 day/10 °C =30-40 days (Incubation time)

Control Fungal Infection For Eggs:

1) Malachite green 1-2 mg / lt 1 hour / day
2) Formalin (30%) 1-2 ml / lt 15 min / day
3) Methylene blue 2 mg/lt 15 min / day

- These chemicals are poured into the trough egg tray
  (Apply every 2 days or more)

REARING OF RAINBOW TROUT FRY

- After the larvae hatched and approximately 2/3 of yolk-sack consumed, feeding starts.
- Feeding starts in hatching canal or tank
- In 3-4 weeks, fish do not feed from the bottom
- Artificial dry feed is used for feeding.

Fresh Products:

- Generally, the beef spleen is used. (It is passed through the meat

Dry consantrated products:

- It can be powder, crushing or pellet.
- Composition may be different (fabricated or specially prepared)

Production of Commercial and Portion Trout

- After contunues selection according to their sizes, rainbow trout fries are need to be fed until being portion size trouts it is accepted 150-250 gr

- They are kept in a pond that is 100-500 m^2 rectangular shapevand its deepth must be 1-2 meters.

- Ponds bottom can be soil and side walls are supported with stone, wood and concrete to prevent collapsion.

CULTURING OF CARP

Cyprinus carpio Linneus, 1758

SCALY CARP

MIRROR CARP

- Greenish-brown back and yellowish-white abdomen
- The body is long,.
- Lateral line scales number : (35-38)
- Head is relatively small
- Mouth terminal, lips are thick.

Living conditions :

- Likes warm water.
- - Lives at the bottom slow-flowing, low-sanded, planty and muddy areas
- Omnivore
- The optimal temperature is 20ºC.
- The carp reach maturity at the end of 3-4 years
- If the water temperature drops under 13ºC, the growth slows down and feeding stops at 5ºC.

MIRROR CARP AND SCALY CARP ARE SUITABLE FOR CULTURING

35-50 gr in first year.
2nd year 250-500 gr.
3rd year 1000-1500 gr.

Main criters:

- Water: clean, sweet and always renewable
- The amount: 0.5-1 l / sec.
- 18-24ºC
- pH 6.5-8.5
- Carp ponds must be soil. (in terms of nutrition)

CULTURING

Semi-controlled Old, simple method

Broodstocks place in the pond during the production season and fish are obtained after 6 months-1 year from the pool

Controlled

- Spawning
- Hatching
- Breeding Larvae **Breeding Broodstock are all controled**

Spawning and Hatchary : there are 2 method

I) DUBİSCH method:

(1) It can be Small ponds (100–1 000 m2).
(2)–(3) 2 females and 3 males per set are stocked.
(4) After spawning, breeders are removed.
(5) Developing eggs and larvae can easily be Observed

II) spawning on kakabans:

(1) – (2) broodfish are stocked into small, freshly flooded ponds where spawning substrates made out of plant fibres (kakabans) are placed.
(3) Eggs stick to the substrate.
(4) – (5) Spawning substrates with eggs are placed into a new pond or into wire-meshed boxes.
(6) Larvae are stocked from the old pond into a new one

III) HORMONE INJECTION AND SEMI-ARTIFICAL CULTURING

In semi-artificial propagation, one single hormone injection helps to induce spawning.

(1) Broodfish are injected (3 mg of hypophysis per kilogram of Bady Weight

(2) Broodfish are transported to spawning ponds.

(3) Broodfish are stocked into a freshly in grassy pond.

(4) It is to be expected that the broodfish will spawn on one of the following mornings.

ARTIFICAL CULTURING is possible for curp culturing also

(1) Injection of suitable broodfish with gonadotropic hormones. (2) Stripping of eggs and sperm). (3) Fertilized eggs are incubated in hatchery jars. (4) Hatched larvae are placed and reared in large jars. (5) As soon as larvae start to feed, they are stocked into nursery ponds.

Stripping sexual products (eggs and milt)

Fertilization and treatment of eggs

Artificial fertilization should be carried out under dry conditions.
Fertilizing solutions should be used to prevent eggs sticking together.

Fertilizing solution:
10 lt water, 30 gr urea, 40 gr NaCl.

Gilthead sea bream (Sparus aurata) Culture

GREY MULLET FISH CULTURE

Seabass Culture

Eel(Anguila spp.) Culturing