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**Using The lake Water Of King Fahd Dam at WadiBisha in Fish Farming with the most Updated Techniques.**

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**Who “Allah’s Almighty” mocked the sea to eat him tender flesh, and extracted from it an ornament, to wear it, and to see the ark in it, and to seek its bounty, and May you be thankful” (14)**

I start this research by Blessing Allah’s Almighty for accomplishing this piece of writing which is deemed to our the fruit of our continuous efforts, and we would like to dedicate this successful research to our parents to be proud with this accomplishment which we aim to be useful and satisfactory to our instructor*: Aziza El- shamrany.*Thus, we start our research by blessing Allah Almighty who inspires us to write such research. We also dedicate the result of our efforts to our parents who raised us, to every instructor taught us a letter in this life, and consequently helped us to reach this level.

**Gratitude and Appreciation**

Praise to Allah, and May His Peace and Blessings be upon the Noblest of Prophets and Messengers our prophet Mohammad and his companions and family until the doom day.

We would like to thank everyone assisted in executing this research and to every instructor taught, directed, assisted us, and on the top of those comes:

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**The Research Summarization**

King Fahd Dam is regarded as the biggest dam in the kingdom of Saudi Arabia: as its height reaches to 103 meters, storage capacity equals to 325 million cubic meters, the dam spot height tends to be 250-kilo meters and the floods water collective area for this dam reaches 7600-kilo cubic meters.

In addition, it rains heavily in the headwaters of this valley and its tributaries. The lake of King Fahd Dam is a large lake where floods water collected inside. Since the lake contains water all over the year and after geographical studies, it turns out that, it is difficult to practice fishing in this lake. Thus, we have carried out this study, which aims to utilize the lake water in fish farming by designing home fish farms filled with the lake water or by digging fishponds next to the lake to be utilized in fish farming in order to increase the fish production, varying the income sources and increasing job opportunities. Chemical and biological analyses done to know the appropriate kind of fish for this lake areCarp Fish, which are already existed in this lake. Through applying the most updated techniques in fish farming, we shall improve the quality of the lake water. Thus, we recommend using the lake water in fish farming.



**In line with 2030 vision**

For a better environment and for the best utilization of the natural & environmental resources.

The kingdom has focused on building strategic agricultural companies with the nations, which have natural resources like water and soil. As the kingdom has several dams which store the rainwater, behind each dam there is a lake full of water, and if we did not utilize from the lake water perfectly and economically, the lake water will be evaporated due to the kingdom hot climatic conditions.

Thus, we thought of carrying out fish farms beside the lake for the optimum utilization of this water, supporting the industry of fish farming and providing job opportunities for youth while changing the nutritional habits for WadiBisha to be more healthy and this target is in line with 2030 future visions.

**Introduction**

King Fahd Dam at WadiBisha south of Bisha in the’ Asir region of south Saudi Arabia Kingdom, in the houses of Bani Madden “Shahran El Areeda “, and it is considered the second largest dam in the Arab World after the High Dam in Egypt.

Noting that King Fahd Dam is the highest dam in Saudi Arabia with 103 meters height and with the largest the storage capacity, then Wadi Hail comes in the second rank.

Moreover, the kingdom has more than 51 dams with more than 15 meters height, and these dams will be increased to be 61 before the end of this decade.

This project stands within the water and electricity ministry plan to improve the water resources and maintain them, in accordance to the instruction of the Custodian of the Two Holy Mosques “ KingFahd Bin Abdel Aziz and his Crown Prince for ensuring the most important life element which is water.

WadiBisha is one of the largest valleys in the Arabian Peninsula, as its widthismore than 450- kilometres, the collective area for the floods water is 7600 kilometres, andit rains heavily in the headwaters of this valley and its tributaries.

The utilizations of these dams are in line with the applied programs set for every dam and the needs dictated in the area of each dam. These dam programs are subject to a periodical study and assessment after each flood period.

**Fish Farming:**

Means the raise of fish under intensive aquaculture circumstances, and despite of the huge development achieved by the fish farming sector at the Kingdom in the last years, fish farming stands as a beginning sector concerning its production volume and influence on the Kingdom’s economical growths. The initiative steps started with studying the fish farming reality and proposing suggestions for introducing the outlines of the aquaculture production at the last seventies through the white fish Authority that performed the first researches related to the fish species and the possibility of establishing fish farming projects in the kingdom.

**The problems of the study:**

The lake water pollution due to the mortality of fish, especially in summer, thus, it was suggested to filter the lake water and utilize such water in farm fishing by moving the lake water in fishponds next to the lake to provide job opportunities and change the nutritional habits.

**The purpose of this research:**

1. Utilizing King Fahd Lake water.
2. Changing the society nutritional habits.
3. Executing small profitable projects to provide the appropriate food for fish farming.
4. Applying the most updated techniques in fish farming.
5. Filtering the lake water.

**The Importance of this Research**

Utilizing the environmental & natural resources in WadiBisha to develop the society economically and hygienically.

**The hypothetical questions:**

* Is the lake environment suitable for the fish?
* Is the geographical and climatic environment in WadiBisha suitable for fish farming?
* Is the lake dam can be used as a fish farm to raise several kinds of fish?
* Are there any contaminants in the lake that affect the growth of these fish?
* Are the updated fish farming techniques lead to the increase in fish production and lake water filtration?

**Hypotheses:**

1. Considering fish farming and aquaculture, we should select the appropriate location: being close enough to a permanent source of water, which is suitable for the soil and water plankton to feed the fish.
2. Taking Samples from the lake water to be analyzed biologically and chemically for determining its suitability for fish farming.

**The Research Literary Framework**

Fisherman's mental and physical nourishment, they prevent from various diseases such as heart diseases. As the recent medical researches asserted the importance of fish oil in reducing the cholesterol and the fats percentage in the blood, which causes atherosclerosis, and heart diseases. Fish also maintains Man’s health by reducing the blood pressure, preventing the dermatological diseases and arthritis.

One may ask how fish could possibly be so useful. The answer would be.

Fish is a premium source of protein, it exceeds the meat nourishment value. Although the period required digesting the fish is the same required for digesting the meat. Thus, one feels less satiety after eating fish more than meat. Also, fish is on the top of nourishment a generator, as one gm/ tuna contains 207 calories while one gm/ meat contains only 172 calories. In addition to that, fish contains proper percentages of fats according to their species. Some kinds of fish contain only 1%, and other 2% as total fat percentage of their weight and others like the tuna fish contains 15 % fat percentage. Noting that one kind of species contains different fat percentage; this is according to its volume and spawning season.

**Fish Farming:**

**The advantages of fish farming:**

1- Producing unpolluted fish.

2- Providing large amounts of fish, so there is no need to change the water inside the fishpond daily, such water can be utilized in irrigation, if there is agriculture.

3- Providing large quantities of forage which are put for the fish.

**The practical steps for constructing fish farming project.**

**If you want to establish a fish farming project, consider the following:**

1. Selecting appropriate location for the fish desired to be farmed according to the environmental requirements needed for this species.
2. In case of practicing fish farming in intensive aquaculture circumstances, Preliminary soil analysis should be done to know the soil capacity to preserve water and it is free of harmful substances.
3. Performing a study to be acquainted with the provided water quality and its quantity, noting that the berkeds, waterways, and shallow wells can be used in freshwater fish farming.
4. It is highly important to study the market requirements before starting the project to facilitate the marketing of the products and to know how far the customer accepted such products or not.

How far WadiBisha is a suitable area for fish farming,

Despite the fact that Bisha is not bordering the sea, but it contains King Fahd Dam (to allocate rains water).

**After studying the water of the dam lake by specialists in the faculty of science, it was found that:**

* The dam lake contains Carp Fish which are suitable for farm fishing for several reasons: the fish carp will be used as fish fingerlings for fish farming as these fish are diversified in nourishment, and they resist the climatic changes.
* After a microscopic examination for the water, it was noticed hugevegetal Planktons that will be used for fish carp nourishment.
* After the water chemical analyses, it was noticed that the dam water is totally valid for fish farming.
* It is hard to practice fishing in the dam water but various quantities of water can be moved to perform fish farming projects in other places.

**The fish forage:**

The carp fish farming depends on Vegetal Planktons nourishment: green algae in the water for the rapid fish growths while putting dried bread feed or wet grains like: wheat, corn and soya.

**The freshwater characteristics for appropriate fish farming:**

* The physical characteristics
* The fishpond depth should not be less than 90 cm.
* The fishpond wall should be made of substances that avoid water leakage, and allow the Vegetal Planktons to be easily hanged.
* Turbidity didn’t increase more 20-30%

**The Biological Features:**

Fish farming water must contain bacteria to analyze the produced fish wastes of carbon and Nitrogen, in addition to huge quantities of vegetal Planktons to produce Oxygen and to be used as forage for some kinds of fish.

Some animal Planktons are also used as fish forage, besides suitable vegetal Planktons must be existed to provide Oxygen without blocking the lake water.

**The Chemical Characteristics:**

* Dissolved Oxygen 5.5-6.5 mg/l, and it is the main factor in fish farming according to the climatic changes and water currents rates.
* PH 6.5-9.5 must not increase the acidity level, as the mildly acidic level is appropriate for fungus growths which will destroy the fish finning.
* Temperature 15-40
* Total hardness 50-300 ppm
* TDS 100-1000 mg/I
* NH3 – NH4 rate must not exceed 0.02 mg/I as the ammonia rates will be controlled by PH and the temperature. If NH4 is raised, it will turn too NH3, which will affect the fish elasmobranches.
* Alkalinity 200-300 ppm ( the Fisheries General Authority 2014)

**Biofloc Technology**

The Biofloc Technology depends on the balance between carbon and Nitrogen in the solution, then we will find the ammonium with the solid Nitrogenous wastes, which will be transferred into bacterial biomass and by adding the Carbohydrates at the fishpond ,the heterotrophy bacteria will be increased and subsequently increase the Nitrogen consumption during the microbial protein.

The Biofloc system depends on developing the water characteristics by adding extra carbon elements in fish farming water or by increasing the carbon levels in the forage and due to the bacteria that consume dissolved Nitrogen in water, the Ammonium will be reduced fast and consequently vanished by Nitrification. As the ammonia rates are reduced 10 times in the Biofloc system in contract with other traditional methods.

**The strength of Biofloc Technology:**

1- Reducing the water changing rates in the aquaculture system compared to the traditional methods.

2- The Biofloc production is low cost and contains high protein levels, and can be used for nourishing aquatic organisms.

3- This economical technology consumes less water with an average 30% and increases the protein consumption.

4- Unlike the traditional methods, the Biofloc system can be used in getting rid of the dissolved Nitrogen in water even during the existence of the solid wastes when the BOD is highly required.

**The Previous Studies**

The study performed by the researcher RihamHamdyElmagazy 2012 for the obstacles that may hinder fish farming projects. In Egypt the fish are considered an economic substantial for fulfilling the shortage of the animal productions, though, Egypt still face several shortages in utilizing Egypt fish resources. Thus, studying these obstacles targeted the economic studies for the Egyptian Fish Farming in general.

This problem can be handled by studying:

* Fish Farming status in Egypt.
* The economic studies for aquaculture through previous studies.
* Studying the economic measures for fish farming and the obstacles of developing it.
* A practical study conducted in the Saudi Chamber Council asserted the importance of fish farming as it is economically viable. Such projects support the food security and Saudi plans in the Kingdom in addition to providing several national employment opportunities. The study mentioned that the statistics of the Agriculture Ministry which states the high annual investment revenue resulted from such projects reaching 20% while the recovery period will be 5 years for huge projects and three years for little ones. The study clarified the advantages of fish farming investments among these the continuous production of fish regardless the season or the political, market and consumer conditions.
* Dr. Ahmad Abdel Wahab asserted the importance of applying the updated techniques in aquaculture and fish farming, marking the technology element as a highly productive element affecting other productive factors. Noting that such technology and investments break the barriers of time and place (Information and Communication) and the barriers of materials (Energy and the new substances) and the barriers of spawning seasons.
* While handling the obstacles which may face the Fish Farming Projects in Sudan 2013 by the researcher Amal Ibrahim, who considered fish farming as one of the best means to obtain the highest fish production rates and subsequently providing the protein to the society, in addition to that solving the unemployment problems which are exacerbated by the economic circumstances. Fish farming with its comprehensive system helps in Agriculture holdings and the best utilization of the irrigation water. The study recommended using the practical methods upon the establishment of fish farming projects, and especially the fishpond designations, the operational Division and qualifying a cadre of technicians to improve such field, besides executing a program that include the official’s periodical visits for fish farming, activating the directing and serving role, and encouraging the investors and farmers in farm fishing projects.
* Executing a central laboratory for the climatic Agriculture in Egypt in cooperation with the food & Agriculture organization 2003 to form fish farming above the roof houses including the unpolluted fresh fish production. Although, the project initiatives were promising but the project stopped because of the NH gas which resulted from the fish wastes during the renewal of the fishponds, as this gas helps the growths of the algae resulting a blockage in the sewage pipelines.
* NourEl-din the Egyptianscientist have explored new techniques to filter the fish farms ponds from the microbes 2017 by a substance that holds these microbes or parasite or the harmful metal. This substance is united with the ions of the heavy elements or the toxic elements resulting carbons, thus the undesired element will lose its activation and ability and won’t be absorbed by the fish.

**Methods & Tools:**

The periodical borders for the study 1438/1439

The place borders for the lake of King Fahd Dam and the nearby places in Bisha Town



A map clarifies the places of the Dam (Form No:1)

**The Experiments:**

* The physical analysis of the dam lake in Bisha region.
* Allocating 6 water samples from different places of the lake water at the different regions in Bisha, while performing the following analyses :
* Biological analysis for the samples ( a microscopic examination for the algae in the water)
* Chemical Analysis for the samples and turbidity
* (Total Hardness, TDS, Alkalinity,PH,DO)
* (conductivity) ( Health Canada 2007)

**Tools**:

Designing the home-made fish farming projects (Example no: 3)

The Modificationsincluded for the designs to limit the polluted water in the units (example 4)

Digging Fishponds next to the lake to be used in open-area fish farming (example 5)

**The results & Discussions:**

**The physical analyses:**

**According to the faculty of science results and the water services laboratory at Bisha Governorate:**

* The intermediate water depth in the dam lake between 55-60 meters.
* According to the civilian opinion, that it is difficult to fish in the dam lake as the beach is uneven and the depth is different, thus the fish quantities and volumes are increased, in addition to the climatic changes and the changes occurred in the water levels, which may result a decrease in the water level and consequently pollute the water.
* The Turbidity level.
* MeasuringtheTurbidity level in the lake water, so the Turbidity level in the fish farming water will be between 40-30%, according to Fisheries General Authority standards in Egypt.

**The chemical analyses results:**

Through the results of the lake water samples analyses in the water services laboratory at Bisha Governorate and the faculty of science, it was found that these results are close and while comparing such results to the water samples analyses for fish farming according to Fisheries General Authority standards in Egypt 2014, provided that this water is free from any toxic or heavy elements, according to the reports of the Ministry of Agriculture. In 2015, these analyses of the damwater samples were in compliance with the allowed limits.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DISSOLVED OXYGEN | Total hardness | Alkalinity | TDS | **PH** |
| Mean 6.5mg/l | Mean  175ppm | Mean  250ppm | Mean  500 mg/l | Mean  8 |

**The lake water analyses according to the faculty of science laboratory Form 1**

|  |  |  |  |
| --- | --- | --- | --- |
| Serial | The statement | Value | The unit |
|  | PH | 7.9 | PH |
|  | COND | 7.6 | COND |
|  | TURB | 4.89 | NTU |
|  | The lake maximum depth | 60.50 | Meter |
|  | The water currents pushing speed | 04 | Meter/ second |
|  | The salinity degree | 400 | Mg/ liter |
|  | The total dissolved salts | 351 | Mg/liter |
|  | The dissolved Oxygen in water | 7 | Mg/liter |

**The analyses at the water services laboratory at Bisha Governorate**

**The Biological Analyses:**

While examining the dam water samples under the microscope at the biological sector in the faculty of science we have reached the following results:

1- The green algae numbers reached from 200-250 algae due to the immense Planktons in the water, which looks green and this percentage is suitable for farming fish nourished on vegetal planktons according to the former studies in fish farming.

2- The numbers of animal plankton from 25-30/ mm3 / water, and this percentage is suitable for farming little numbers of fish with various nourishments, according to the former studies in fish farming.

3- Some little warms in some samples and others not.

4- Through This study, we have concluded that this lake is suitable for fish farming and especially Carp Fish, tilapia, and the catfish

Due to the different difficulties of fishing in the dam lake and to reduce the loss of water through the sea, we have designed homemade fish farms or next to the lake.

Designing homemade fish farming ponds.

The possibility of executing more than one fishpond on the roof or the garden and transporting the dam water by vehicles to fill unites.

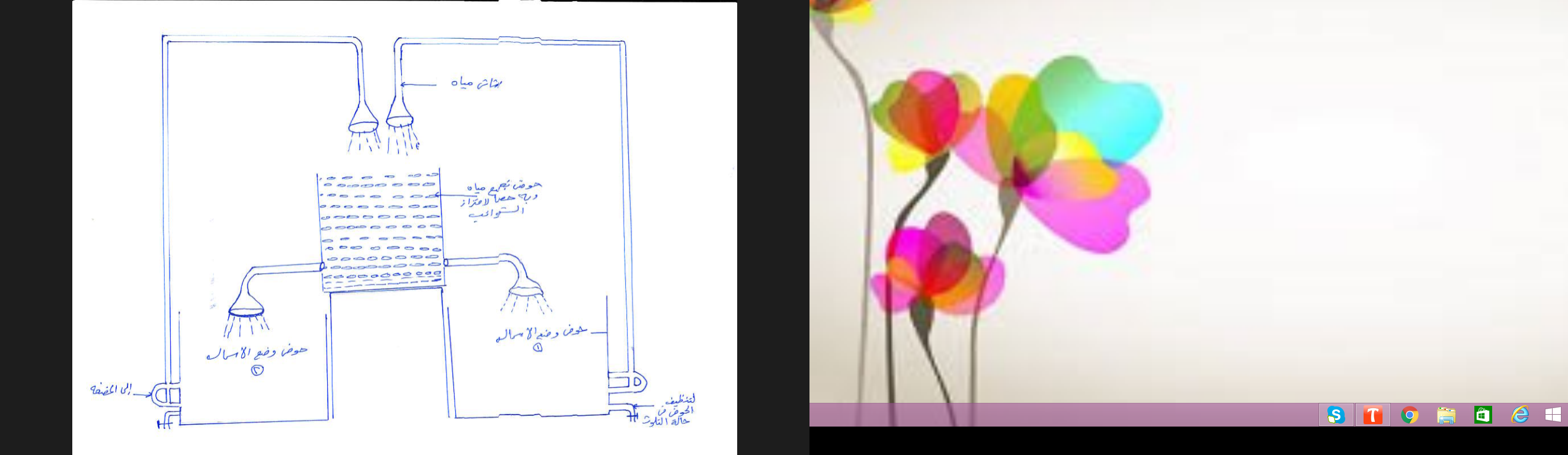
Installing the units, every unit consists of 2 plastic containers, metal container, motor and some pipes to take the unit area 3\*3 meters2.  The container designs in the form 4 whileshadingparts of them to allow the air to get into the containers.



**The homemade traditional farm fishing ponds form 3**

The water containers are filled with 400 meters of water/ unit from the dam water.

Operating the water motor for 4 hours before setting the fish, in order to move the water and getting rid of the fish from 100-150 fish/ unit while measuring the water temperature 3 times daily. As the fish forage is determined by 10% from the fish weight and the forage is decreased as the temperature gets high: if the temperature reaches 30-40 c, the forage is added to the algae with the largest quantity of chlorine while mixing the water with the largest quantity of oxygen then we put the fish fingerlings.



**The modifications included in the farm design form 4**

The modifications included in the farm so to keep the water in an isolated system.

Moving 400 liters of the dam water to fill the unit and designing the fish farm with an isolated water system so the unit won’t consume much water.

Placing large quantities of rocks and sand in the metal container to remove any impurities and fish wastes.

Controlling the water motor to push the water up with a slow equipment in order get rid of the wastes and mixing the air.

Designing the water pipelines as sprinklers till increasing their length till 1 meter to mix the water and consequently increasing the Oxygen.

Removing the largest chlorine quantities for not using the air pumps while applying the Biofloc techniques.

Placing the Largest quantities of green algae to the water to increase the oxygen percentage and spawning.

In case of digging fishponds next to the lake for fish farming, the fish pond is gigged with 30 meters diameter while transporting the lake water through pipes to provide the best protein nourishment m placing vegetal plankton, algae, and applying the Biofloc techniques in filtering the water and the water can be transported back to the lake after fish farming, but in this case the water must be filtered by applying the Biofloc techniques.



**The fish ponds dug next to the dam lake form 5**

For saving costs, one can use the fish fingerlings of the Carb fish in the dam water with the length of 1-5 cm.

Using the forage from the environment like dried bread and wetgrains for feeding Carb Fishes, as the studies proved the possibility of changing the nourishment habits during fish farming.

**The conclusion:**

With regard to the previous conclusions, it is clear that the lake of King Fahd Dam is suitable for fish farming all over the year while applying certain conditions that control the climatic circumstances around the fish in the lake, and this is definitely difficult to be applied due to the lake large scale, thus we strongly recommend the following:

1- Establishing fish farms by the dam water whether homemade or dug next to the lake and these fish ponds will be easily controlled concerning temperature, removing impurities, and fishing at any time by simple equipment.

2- Encouraging the youth to Establish fish farms as a small project to provide all the facilities to establish the projects.

3- The continuous joined researches with the specialists in the environment field at the universities and consulting them in any emergency cases.

4- Carrying out awareness programs for the society to highlight the importance of the correct nourishment and especially fish proteins.

5- Establishing markets to present and marketing the fish farming products.

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