# COMPREHENSIVE SURVEY ON THE LEVEL OF FISH MANAGEMENT IN FRESH WATER FISH FARMS IN EGYPT

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## SUMMARY

This study was conducted to evaluate the level of fish management in Egyptian fish farm, five major sectors of aquaculture represented by five governorates (Kafrelshakh, El-Sharkea, El-Behaira, Ismailia, and El-Fayuom governorates); about 85 fish farms were assessed for two successful production seasons from September 2009 to September 2010. For each fish farm we recorded, the fish stock management, including the source of the fry, fry transportation, cultured species, culture system, acclimatization, stocking density, medication, fish sampling, harvesting and marketing. Feeding management, including feed types, feeding methods, feed amount and feeding frequency. Water management, including the water source, water exchange regimen, and water quality measurement, finally the problems facing fish farms were recorded. Obtained results have detected the level and degrees of different management practices in the Egyptian fish farms to spot light on the problems affecting the productive performance of fish farms in Egypt.

**Key words:** Aquaculture, fish management, earthen ponds, Tilapia, monoculture, polyculture, extensive, Semi-intensive and intensive system.

## INTRODACTION

The greatest increase in human population parallel to shortage of animal protein all over the world directed the attention to fish as rapid and healthy compensatory source of good quality protein **(El-Bassuony 2005)**.The aquaculture is one of the fastest growing food production sectors as the fish is an important source of human dietary protein. Therefore increasing in fish production from aquaculture is an important goal of the Egyptian government **(Soliman 1995**). Aquaculture in Egypt classified into seven sectors represented by the different governorates as following, Western sector, Middle of Delta, Damietta, Eastern sector, Nile Valley sector, Red Sea sector, and Aswan sector **(GAFRD 2007)**.

The aim of good management is to obtain the best returns possible from the effort involved and money invested. The management of fish farms involves for examples choosing of the fish species, handling, transportation, acclimatization, providing the fish with adequate food, insuring good water quality, harvesting and marketing of the fish. **(Stickney 2000, Lucas and Southgate 2003, Aloyce et al., 2006)**. So the study aimed to make a survey on the level of fish management in fresh water fish farms in Egypt, on the basis of recording the different management systems of fish farms in five Egyptian Governorates and Spot light on the problems affecting the productive performance of fish farms in Egypt.

## MATERIALS AND METHODS

### Location and Time of the Study

This study has been conducted to cover aquaculture sectors in Egypt according to the classification showed by **(GAFRD 2007)** and mentioned in **table (1)**.

Five major aquaculture sectors represented by five different governorates, about 85 fish farms (3 governmental fish farms and 82 private fish farms) were the subject of current study. These farms were distributed as follow, 30 farms in Kafr El-sheikh, 15 farms in El-Behaira, 15 farms in Ismailia, 15 farms in El-Sharkea, and 10 farms in El-Fayuom.

The study was continued for two successive production season, the first season was from September 2009 to April 2010 and the second was from April 2010 to September 2010.

**Table (1) Distribution of aquaculture sectors in Egypt according to (GAFRD 2007)**

| Area/ sector | Governorates | Area/feddan |
|---|---|---|
| **1- The Western** | Matroh | 10 |
| | Alexandria | 10710 |
| | El-Behaira | 30769 |
| **2-Middle of the Delta** | Kafrelshakh | 144607 |
| | EL-Gharbea | 0 |
| | EL-Kalubea | 4 |
| | EL-Minofia | 210 |
| **3- Demiatta** | Demiatta | 60436 |
| | El-Sharkea | 33445 |
| | El-Dakahlea | 1437 |
| **4-The Eastern** | Port Said | 53391 |
| | Ismailia | 16997 |
| | North Sinai | 0 |
| **5- The Red Sea** | Suez | 480 |
| | Red Sea | 0 |
| | South Sinai | 175 |
| **6- Nile Valley** | Cairo | 0 |
| | Giza | 206 |
| | EL-Fayuom | 2257 |
| | Beni Suef | 66 |
| | El- Minia | 0 |
| | Asuat | 0 |
| | El-Wadi El-Gadid | 5080 |
| **7- Aswan** | Aswan | 0 |
| | Sohage | 0 |
| | Qena | 0 |
| **Total** | ---------- | 360280 |

## Scheme of the Study

Methods of recording of the results were written reports; photograph and video tape recording according to (Marten and Bateson 1998). Data of the visiting farm were collected either by farm records or by

special designed questionnaire models used during the study. The questionnaire models include the following items; Stock Management, Water management, feeding management, and fish farm problems.

**Stock Management**

**Source of the Seeds (Fry /Fingerlings)**

The source of fry and fingerlings were recorded according to **(Nour 2001)**, three sources were used 1- Local private hatchery (LPH.**)**, 2- Company hatchery (CH), and 3- the same farm hatchery (SFH).

**Species and Culture System**

Fish culture systems were classified according to **(FAO 1998)** into the following; according to the number of cultured fish species into monoculture system and polyculture system, and according to the type of water into Fresh water fish (Tilapia, mono sex or mixed sex, carp and catfish), and Brackish water fish.

**Handling and Transport**

Seeds (fry or fingerlings) were transported either by using polyethylene plastic bags or water tanks. Where the plastic bags should contain ⅓ -$^{1}/_{4}$ of the bag volume water and inflated with oxygen and sealed with rubber or elastic band or heat sealer according to (**Stickney 2000**, **and Mahrous, et al. 2007)**.

**Acclimatization**

The fish seeds (fry/ fingerlings) were acclimatized just on arrival on the farm and before releasing into the water where they have been kept for about 10- 20 minutes to reduce stress and minimize mortality **(Saleh 2008, and FAO 2008)**

**Brooding and Stocking Density (SD**

Seeds (fry/ fingerlings) after they had been acclimatized, are either brooded for 3 months or spreading directly into the rearing ponds. The stocking density of fish per feddan was differed according to the system of culture used, in the extensive system the SD was 5000-10000 fish/feddan, the semi-intensive system is 10000-25000 fish

/feddan and intensive system is 25000-50000 fish /feddan, according to **(Lucas and Southgate 2003).**

**Drugs and Medication**

vaccination or medication programs were recorded in current study, some farms (rare) used antibiotics, and vitamin C when necessity arise.

**Periodical Fish Sampling**

Fish sampling was differ from farm to another, some farms take sample every 15 days, or every month to judge on the growth rate, nutrient requirements, weighing or other purposes such as diseases diagnosis.

**Harvesting and Marketing**

At the end of the production season fishes were collected or harvested and sent to the market either in fish boxes (iced fish) or in water tanks (a live fish), also the time of harvesting was recorded (**Anita and Christopher 1997)**

**Feeding management, (Types of Food and Methods of Feeding)**

The food was offered to the fish either in feeders or spreading by hand on water surface. Four types of feeds were used 1- commercial pelleted feed, 2-handmade ration, 3-untraditional feed (agricultural wastes) or 4- combination between untraditional and handmade ration.

The quantity and rate of feeding, in the most of the studied farms were introduced once, twice or third times daily according to **(Davis and Schreck 1997)**.The amounts of food given to fish were either as percentage from fish body weight or given at random**.**

**<u>Water Management</u>**

**Water Source and Exchange**

The different sources of water were identified in the farm; different sources that were used included, Irrigated Nile water, Lakes water, Agriculture drainage water and Waste water. The regimen of water exchange has been differed from farm to another, some farms change

the water daily, others every week or every month and or when necessity arises.

**Water Supply and Drainage System**

The methods of water supply used in the farm were recorded; water machines were worked either by gas or by electricity or act by gravity (Raha system). The main drainage system in the studied farm was either fixed pipes, wire gates, and or movable pipes (Siphoning system).

**Fish Farm Problems**

The most common problems facing fish culture in the different Egyptian governorates under our study have been recorded.

## RESULTS AND DISCUSSION

**Stock Management:-**

**Source of the Seeds (Fry /Fingerlings)**

Local private hatchery (LPH) represents 77.32 % as a source of fish seed in all of studied farms followed by the same farm hatchery (SFH) which represents 20.68 % as a source of fish seed of and finally come the state or governmental hatchery (GH) as a source of fish seed as it presents 2% only in all of the studied fish farm, This agreed with **(GAFRD 2007)** that mentioned to the governmental hatcheries were not able to meet the demand for tilapia seed, so it was facilitated issued licenses for private hatcheries to produce mono-sex and/or mixed sex tilapia to enable farmers to stock their farm with seeds in the right time.

From the field visits we recorded that the main source for the Mugil Cephalus, and Mugil Capito in the fish farms in Egypt was the wild-caught mullet seed, Mugil Cephalus fry season recorded in August to November while Mugil Capito recorded in December to March and both can be obtained from the collection centers after the period of adaptation on the brackish water as mentioned by (**Radwan 2008 and Saleh 2008).**

**Culture System and Cultured Species**

From table (2) it can be observed that the monoculture system presents 30.6 % of the total fish cultured (26 out of 85 studied farms in Egypt) compared with the polyculture system which presents 69.4% of the fish cultured (59 out of 85 studied farms in Egypt).

The fish species cultured in the Egyptian fish farms have been illustrated in **plate (1)**, these includes 1-Tilapia species "*Oreochromis Niloticus, Nile Tilapia* ", 2-Mugil species " *Mugil Capito*"," *Mugil Cephalus*",3-Carp species and 4- Cat fish species "*Claris Lazera*" respectively. In the mono culture system Tilapia represent the only species of fish cultured in Egypt. On the level of the monoculture system tilapia monosex cultured in 96.2 %, while tilapia mixed sex cultured in 3.8% of the farms that used monoculture system. Concerning the governorates differences, **table (2)** showed that in El- Behaira tilapia monosex cultured in 86.7 % of the fish farms, El-sharkea 33.3%, El-Fayuom 20 %, Ismailia 13.3% and Kafr El-sheikh 10% respectively while Tilapia mixed sex has been cultured only in Ismailia fish farm 6.7 %.

On the level of the polyculture system several combinations of tilapia and other species have been used. From **table** (**2)** it can be noticed that these combination included, *Nile Tilapia* monosex */Mugile Capito* cultured in 42.4 %, *Nile Tilapia* monosex /*Mugile Capito* /*Mugile Cephalus* cultured in 35.6%, *Nile Tilapia* monosex /*Mugile Cephalus* cultured in 11.9 %, *Nile Tilapia* monosex /*Mugile Capito* /*Mugile Cephalus* / *Carp*/ *Catfish* cultured in 6.8% and *Nile Tilapia* monosex / *Carp* cultured in 3.3 % of the farms that used polyculture system.

On the level of the total fish farms in Egypt the percentage of these combinations has been illustrated in **plate (1)** 32.6 % from the studied fish farms cultured *Nile Tilapia* monosex, 20.6 % cultured *Nile Tilapia* monosex / *Mugile Capito*, 23.3 % cultured *Nile Tilapia* monosex / *Mugile Capito* / *Mugile Cephalus*, 13.6 % cultured *Nile Tilapia* monosex / *Mugile Cephalus*, 6 % cultured *Nile Tilapia* monosex / *Mugile Capito* / *Mugile Cephalus* / *Carp*/ *Catfish*, 2.6 %

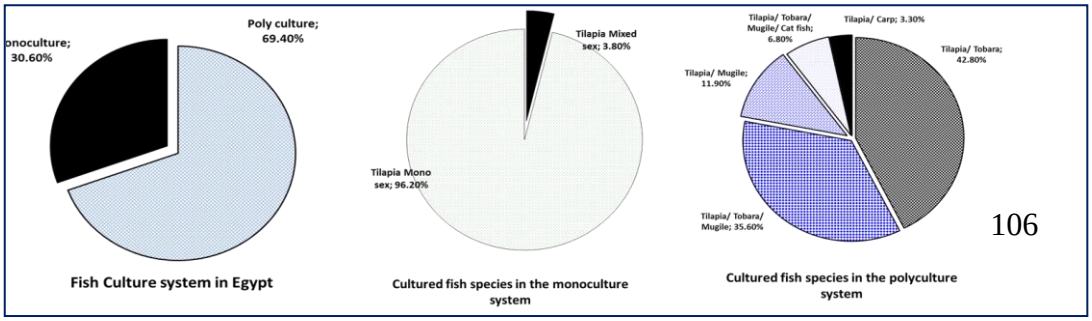
cultured *Nile Tilapia* monosex / *Carp* and 1.3% from the studied fish farms cultured *Nile Tilapia* mixed sex.

The predominance of tilapia species in fish culture in Egypt either in both the monoculture system or the polyculture system indicate that tilapia are the excellent culture species because they grow well on a variety of natural food including plankton, green leaves, benthic organisms, larval fish, detritus and decomposing organic matter, beside the high popularity of this fish among the Egyptian consumers, and this prove the idea that tilapia known among many aqua-culturists as "the aquatic chicken", because tilapia following the highly successful broiler model **(Swick 2001)**.

Table (2):-The Fish culture systems and the percentage of different Fish Cultured species as percentage in Egyptian fish farms.

| | | Governorates | | | | | All over mean |
|---|---|---|---|---|---|---|---|
| | | El-Behaira | Kafr-El-sheikh | El-sharkea | Ismailia | El-Fayuom | |
| Cultured System / Farm number / species | | No=15 | No=30 | No=15 | No=15 | No=10 | No=85 |
| Mono culture No=26 (30.6%) | Tilapia monosex (96.2%) | 86.6 | 10 | 33.3 | 13.3 | 20 | 32.66 |
| | Tilapia mixed sex (3.8%) | 0 | 0 | 0 | 6.7 | 0 | 1.34 |
| Polyculture No=59 (69.4%) | Tilapia monosex / M. Capito (42.4%) | 0 | 63.3 | 40 | 0 | 0 | 20.66 |
| | Tilapia monosex , M. Cephalus and M. Capito (35.6%) | 6.7 | 23.3 | 6.7 | 80 | 0 | 23.34 |
| | Tilapia monosex , M. Cephalus (11.9%) | 0 | 0 | 6.7 | 0 | 60 | 13.34 |
| | Tilapia monosex , M. Cephalus and M. Capito/carp / Catfish (6.8%) | 6.7 | 3.4 | 0 | 0 | 20 | 6 |
| | Tilapia monosex /carp (3.3%) | 0 | 0 | 13.3 | 0 | 0 | 2.66 |

Plate (1):- The percentage of different fish cultured species in Egypt



**Handling and Transport**

Two methods are used for transportation of fish seeds (fry/fingerlings), according to the number and size of the transported fish, the first method by using the poly-ethylene plastic bags, and The second is by using water tanks. It was recorded that about of 72% of the fish seeds are transported by using the first method and 28 % of fish farm transported seeds by using the water tanks.

It was observed that the plastic bags used only for transportation of fry and young fingerlings, as in case of large fingerlings, the well-developed fins can make tearing to the plastic bags, resulting loss of water content, dissolved oxygen and death of fingerlings. Also it was noticed that the stocking density in plastic bags start at 500 and not exceed 1000 fry or young fingerlings /bag according to the fish size and transportation distance, so in large farms the plastic bags is more labor and costly.

**Acclimatization**

It was observed that in most of the studied fish farm about 79.34% are not acclimated their seeds (fry/fingerlings) upon their arrival to the farm and are directly released to the water of the farm. In some fish farms about 20.66% acclimatized the seeds. Four steps are used for acclimatization of the seeds when they are reached to the farm, the bags are left on water surface to take its temperature for at least 10-20 minutes, then the plastic bags are opened to mix the water of the bag with that of the farm, Cutting off the plastic bags and releasing the seed to the water of the pond.

**Stocking Density (S.D)**

According to the stocking density, **Table (3)** showing three distinct fish culture system has been recognized in Egypt and they are distributed as follow, The semi intensive system represents 58.7% from the total cultured systems, followed by the extensive system which represents 38.7% of the total average and the intensive system which represents 2.7 % of the total culture system in Egypt. From the

results we can noticed that the most common system in Egypt was semi-intensive system this agreed with **(Tacon and De Silva 1997)**.

Table (3):-The classification of the Fish culture systems according to the stocking density in The Egyptian fish farms measured as percentage.

| | Governorate | | | | | All over mean |
|---|---|---|---|---|---|---|
| | El-Behaira | Kafr-El-sheikh | El-sharkea | Ismailia | El-Fayuom | |
| Farm number / Culture system | No=15 | No=30 | No=15 | No=15 | No=10 | No=85 |
| 1-Extensive (5000-10000 /feddan) | 6.7 | 26.7 | 60 | 60 | 40 | 38.68 |
| 2-Semi intensive (10000-25000/ feddan) | 93.3 | 70 | 40 | 40 | 50 | 58.66 |
| 3-Intensive (25000-50000/ feddan) | 0 | 3.3 | 0 | 0 | 10 | 2.66 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

## Drugs and Medication

The surveyed 85 fish farms in five different Egyptian governorates indicated that 95.3% of the total fish farm in Egypt did not use any drugs or medication while 4.7 % from the total farms use some drugs specially (vitamin C, and oxytetracycline) habhazard without any scientific bases or knowledge. An erroneous believes exist among fish-farmer, that fish are not suffered from disease as other organisms. Concerning the supervision on the sector of fish farms it was found that 86 % of fish farms in Egypt are not subjected to supervision either from veterinarians or Agricultural engineers, while 14 % of the fish farms are subjected to the supervision.

## Periodical Fish Sampling

Periodical fish sampling is management procedures conducted merely in all fish farms, sampling is practiced for weighing of fish, judge on growth rate and food conversion ratio; calculate the amount of food required and examination of fish for disease diagnosis. It was recorded that the technique of fish sample differ greatly among fish farms, some farms conducted sample periodically every 2 weeks (15 days), others every month (30 days) and in others every 3 months.

61.36 % of the fish farm used the first technique, 27.98 % of the farms used the second technique, and 10.66% of the farms used the third technique. From Managemental point of view sampling every 15 days is better than sampling every one month or every 3 months as this represents a mirror to the fish farmer s on their fish health, feed requirements and production parameters.

**Harvesting and Marketing**

The harvesting of fish may be conducted either at day in 44.66% of fish farms or at night in 55.34 % of fish farms. The differences occur among fish farms in different governorates in this aspect; may be attributed to the desire of fish farmer to stress during transportation especially at the day hours, and this is controlled also by the distance to the available fish market in the governorates. Also it was observed that 34 % of the fish farms harvest their crops of fish in summer (From July- September), 28 % harvest their crops of fish in autumn (October-December)**,** 23.3% harvest in spring (April-Jun)**,** and 14.6% harvest in winter (January-march), the differences in harvesting season may be attributed to the time of the fish cycle in each governorate.

**Feeding management**

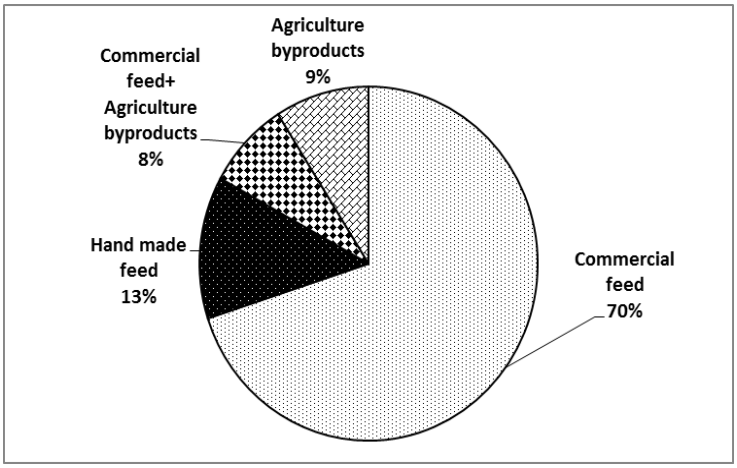
Fish feeding is one of the most important factors in commercial fish farming because feeding regime may have consequence on both growth efficiency and feed wastage**.**

**Feed types**

From plate (2) four types of fish feeds are used in the Egyptian fish farms which are, Commercial pelleted feed used by 70% of the farms, Commercial feed + Agricultural byproducts used by 13% of the farms, Hand-made feed used by 9% of the fish farms, and - Agriculture byproducts used by 8% of the fish farms. While Supplementary feeds can be take up to 60% of fish production costs but it is affordable for most farmers as the commercial company feed is post pond until fish harvesting. While the handmade feed need cash money to purchase the feed ingredient and in the same time the

use of agriculture wastes affect the water quality of fish farms which reflect on the losses percentage and the net profit per feddan so the most common feed type in fish farms was commercial company pelleted feed.

Plate (2) The percentage of different feed types in Egyptian fish farms




**Method of Feed Supply**

**From plate (3),** Several methods have been used for offering food to the fish, Fixed mark where the food is supplied to the fish at a fixed mark where the fish are previously accommodated to obtain their feed at these marks about 56% of the fish farm use these method, Habhazard where feed is introduced to the fish by hand spreading randomly at any site of the farm either by throwing the food by the farmer standing on the dike or by using boat for spreading the feed at different sites of the pond, about 26.6 % of fish farms used this method., third method by using feeders with several form about 17.3 % of fish farm used this method. The Feeders and fixed mark were preferable to the fish farmers because it enable the farmers to check the leftover feed on the bottom of the pond, this agree with **( Berka 1973)** who mentioned that feeding is usually done in a specific place, which can be marked out to enable regular checking for leftover feed.

Plate (3):- The Different feeding methods in Egyptian fish farms


**Feeding Frequency**

The feeding frequency differ from one farm to another, about 48.6 % of the farms offered food to the fish once/day (at early morning from 8-9 hrs.), others 42 % of farms offered food twice a day (at morning 8-9 hrs., and at noon 12-1 hrs.), while 9.3 % of farms offered food three times a day (at morning 8-9 hrs., at noon 11-12 hrs. and at afternoon 1-2 hrs.), from the field observation it can be concluded that fish receiving one meal daily consumed significantly less feed than those receiving two or three meals daily, this means that increasing feeding frequency, increased the amount of feed consumed which in turn increase the food conversion ratio and growth rate of the fish this agreed with **(Marty et, al. 1991),** so it can be recommended that feeding the fish several times a day was better than feeding once a day, from the point of economic performance and fish production return.

**The Amount of Feeds**

It was recorded that two methods are used to estimate the actual amount of feed required by fish, random method represents 72.7 % of the farms and by estimating the amount of feed after calculating the total body mass of the fish after sampling and this represents 27.3% of the farms. From all of the above it can be recommended that estimating the fish requirement by the total body mass of the fish is the best reliable method to obtain the highest net profit and fish production this is confirmed by the results of **(Alazab 2009)**.

**Fertilization strategy**

Fertilization is a common practice in fish culture, the purpose of pond fertilization is to increase and sustain algal growth, which is then transformed to fish yield. Organic and inorganic fertilizers are often used in fish ponds to increase pond fertility and to improve fish production.

It was recorded that about 79 % of fish farms in Egypt used supplementary feeds without any type of fertilizers. Some fish farms in Egypt used different types of fertilizers in addition to the supplementary feed, 15 % of fish farms used poultry litter as organic fertilizers, and about 1.2 % of fish farms used cow manure as organic fertilizers, about 2.4 % of fish farms used chemical fertilizers (Urea and Super phosphate) and about 2.4 % of fish farms used both poultry litter and chemical fertilizers. These results agreed with **(Ram et, al. 2001)** who mentioned that fish fed artificial feed only give higher harvest weight than those reared on inorganic fertilizers, or combination of organic and inorganic fertilizer.

**Water Management**

Water quality in fish ponds is the major factor determining the fish production, water quality is dramatically influenced by pond management practices such as stocking density of fish, fertilization strategy and supplemental feeding. Pond water quality is a major management tool in the semi-intensive production of tilapia and considered as important limiting factor in intensive production.

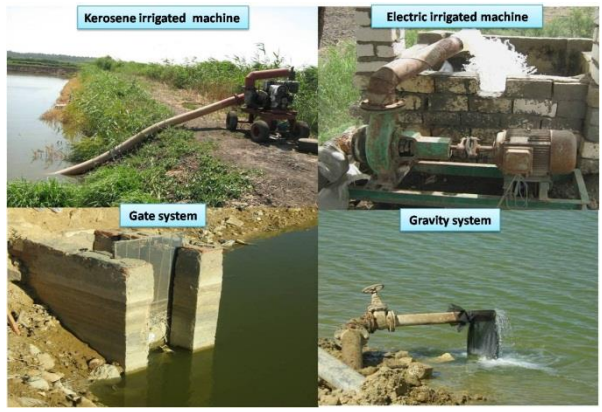
**Water Source and Exchange**

There are four sources of water recorded in the fish farms, Agriculture drainage water used by 80.6 % of fish farm, Nile irrigated water "illegal" used by 10% of the farms, and waste water used by 9.3 %. It has been found that the difference in the using of water sources is governed by the type of water source available and in the same time; aqua-culturists in Egypt are obliged to use the drainage water in filling their fish ponds according to the regulations of ministry of reclamation. From the field visits to different governorates the most important constraint of aquaculture is the prohibition on using irrigation canals; this agreed with **(Kevin 1994)**.

**Water Supply and Drainage System**

From **plate (4)** four systems of water supply were used in fish farming in Egypt, and they are distributed in Egypt as follow, kerosene irrigated machine used by 86.6% of the fish farms, Electric irrigated machine used by 8 % of fish farms, The gravity system used by 4 % of fish farms and the Gate system used by 1.4 % of fish farms. Also several water drainage systems can be used in fish farms in Egypt, five systems are used including, Movable Hose used by 32.6 % of fish farms, Fixed Pips used by 24.6 % of fish farms, Gate system used by 34.6 5 of fish farms, Kerosene irrigated machine used by 1.3 % of fish farms, and Gravity (Raha system) used by 6.6 %of the total fish farms used in this study.

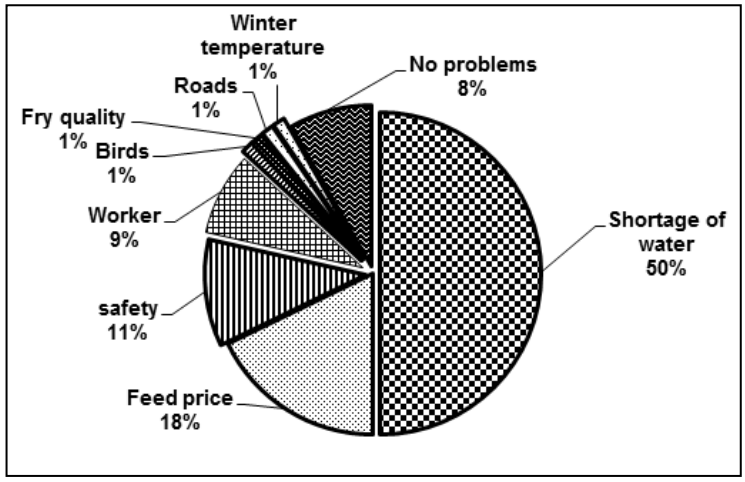
Plate (4):- Different water supply systems in Egyptian fish farm




**Fish Farm Problems**

The aquaculture sector in Egypt is faced by some problems or limitations as represented in **plate (5),** the biggest problem was the shortage of water constitutes 40.4% from the total fish farms problems, the second problem was feed price constitute 17.6 %, then safety constitutes 10 %, then worker and employee 8.2%, then bad weather condition specially winter temperature represent 12 %, finally, Wild birds, Fry quality and unpaved roads represented 1.2 % for each, about 8.2 % of fish farms wasn't face with any problems

Plate (5):- The percentage of different problems facing the Egyptian fish farms




## CONCLUSION

Current study was revealed that the fish farms in Egypt differ in their management strategies and facing different problems, so the aquaculture sector in Egypt needs more attention from the government to solve the problems facing this sector that is one of the fastest growing food production sectors and fish is an important source of human dietary protein. In the same time the fish farms need intensive supervision from the veterinarian to achieve the proper management systems that aimed to obtain the best profits possible from the effort involved and money invested.

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