# CHAPTER ONE
# I. INTRODUCTION

Increasing the population density in the world to about seven billion people, increased the demand of aquatic food Hence, increase expansion and intensification of aquaculture production are highly required to face the continuous growth of human population, Roselien *et al.* (2011). Although the FAO (2008) reported that the annual growth rate of aquaculture production during the last decade has reached 14.3% which is higher compared to the capture fisheries which were 0.5%. Also (FAO, 2012) stated that, aquaculture is predicted to increase 5-fold until 2050 to meet this growing demand. Healthy diets high in its protein value are necessary to ensure that, the growing population does not suffer sickness and diseases. Harvest of wild fish, crustaceans, and other aquatic species cannot keep up with the growing human population demand. Therefore, aquaculture is required to meet the human demand; it also relieves the strain on wild species to allow them to continue to be a significant source of healthy protein diets (Sadek, 2010 and Mutter, 2011).

Total Egyptian fish production reached 1,371,975 metric toones, of which aquaculture participated with 1,017,738 metric tonnes (74.18%) (GAFRD, 2012). Mullet is one of the most popular fish group in Egypt. It is the second after tilapia among the major cultured species. The production of farmed mullet reached 213,980 metric tonnes representing about 30.33% of total production of farmed fish (Essa, 2010). Although, it is the second fish culture in Egypt, the flathead grey mullet *Mugil cephalus* and the thinlip grey mullet, *Liza ramada*, constitute the majority of the harvest of mullet in Egypt. The availability and abundance of the wild fry of these species as compared to those of *Chelon labrosus, Oedalechilus labeo, Liza aurata, Liza abu, Liza saliens*, and *Liza carinata*, make it the dominant aquacultural species (Saleh, 2008). Flathead grey mullet was the popular species of mugilidae which reared in Egypt. This species has been used for traditional aquaculture and culture-based fisheries since the late 1920s and is still of major importance today (Faouzi, 1936; Saleh and Salem, 2005; Basurco and Lovatelli, 2003).

In addition to, a number of biological characteristics makes flathead grey mullet an excellent candidate for culture for instance:

a) Mullet is a euryhaline species and can be cultured in sea, brackish and freshwater areas.

b) They are eurythermal and distributed throughout the warm water of the world.

c) They feed on low protein content up to 22 % CP with 250 kcal/100g diet and grow rapidly, El-Dahhar (2007).

d) Also mullet is an omnivorous behavior that feeds on planktonic organisms (e.g. diatoms, cladocera, copepoda and amphipods) and also on suspended organic matter (Almeida *et al.*, 1995 and Shapiro, 1998).

e) Widely demanded by market, it is suitable for culture in a wide range of farming systems.

Therefore, flathead grey mullet was successful in many countries with different system. The main goal of aquaculture expansion must be producing more aquaculture products without significantly increasing the usage of the basic natural resources of water and land (Avnimelech, 2009). The second goal is to develop sustainable aquaculture systems that will not damage the environment (Naylor *et al.*, 2000). The third goal is to build up systems providing an equitable cost/benefit ratio to support economic and social sustainability (Avnimelech, 2009). All these three prerequisites for sustainable aquaculture development can be met by biofloc technology.

Recently, the basic principle of the activated suspension technique (AST), referred to as biofloc technology (BFT) is the retention of waste and its conversion to biofloc as a natural food within the culture system. This is done by constant aeration and agitation of the water column and addition of carbon sources as organic substrates to allow aerobic decomposition and maintain high levels of microbial floc in suspension in fed and/or fertilized ponds (Avnimelech *et al.*, 1986; Hargreaves, 2006). Theoretically, increased C/N ratio through carbon addition enhances conversion of toxic inorganic nitrogen species to microbial biomass available as food for culture animals. The optimum C/ N ratio in an aquaculture system can be maintained by adding different locally available cheap carbon sources and/or reduction of protein content in feed (Avnimelech, 1999; Hargreaves, 2006).

These BFT systems rely on the living microorganisms in the biofloc (composed of microbial biomass and particulate organic matter) maintained in the water column to assist in ammonia removal via phytoplankton, bacterial uptake, bacterial oxidation of ammonia-N ($NH_3$-N) to nitrite-N ($NO_2$-N) and then subsequent oxidation of $NO_2$-N to nitrate-N ($NO_3$-N) during nitrification (Brune *et al.*, 2003; Ebeling *et al.*, 2006; Hargreaves, 2006). Therefore, these biological processes play a critical role in reducing ammonia and nitrite to levels below those that can be toxic or growth-limiting for cultured mullet fish.

Thus, application of bio-flocs technology (BFT) in aquaculture offers a solution for the three main problems which are mentioned. The first is limited natural resources of water, across avoiding environmental impact of high nutrient discharges which limit water exchange, so this system called zero exchange water. The second is reducing the use of artificial feed. In BFT

excess of nutrients in aquaculture systems are converted into microbial biomass, which can be consumed by the cultured animals as a food source. The third is using concrete ponds or tanks with intensive system that minimizes used acre of lands for mullet culture.

Therefore, the main objectives of the present study were:

1- Studying the effect of C/N ratio levels on biofloc, water quality, survival rate, growth, and economic feasibility to *Mugil cephalus* fingerlings under BFT system with low protein diets, (16, 20, 24 % CP) .

2- Studying the rearing of *Mugil cephalus* fingerlings in biofloc system at different salinities, and its effect on water quality, growth performance, and survival rate.