**Alexandria University**
**Faculty of Agric. (Saba-Basha)**

# EVALUATION OF THE MORPHOMETRIC, MERISTIC, BIOCHEMICAL AND FLESH QUALITY CHARACTERISTICS OF CULTURED AND WILD NILE TILAPIA (*Oreochromis niloticus*)

**BY**

**WALEED NAGY MOHAMED ABD EL-KADER**

**A Thesis Submitted in Partial Fulfillment of the Requirements Governing the Award of the Degree of**

**MASTER OF AGRICULTURAL SCIENCES**

**(FISH PRODUCTION)**

**From**

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**For the Degree of**
**MASTER IN AGRICULTURAL SCIENCES**
**In**
**Fish Production**

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**2009**

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# CHAPTER 1

# INTRODUCTION

During the past few years world fish production was stable at around 125 million tons **(FAO, 2002*)***, a quantity not sufficient to satisfy the consumers need. In order to meet the increase in human fish demand, aquaculture is increasing along the necessary of supplying with fishing products of high quality and also diversified product ***(*****Queméner** *et al.***, 2002)**. Generally, an important success factor is that consumers accept farmed fish to be equivalent or superior to the wild fish **(Olsson** *et al***., 2003).**

Quality terms and how they are perceived differ for the fish farmer, processing industry and consumer. While growth and feed conversion are of greatest importance to the aquaculturist, these parameters are unlikely to be of indirect interest to the latter. However, producing fish that are positively received by processors and consumers alike is naturally of major concern to the fish farming industry **(Rasmussen, 2001).** For example, fish for smoking should contain relatively more fat than fish sold frozen. Moreover, broad (deep) fish are considered more desirable by the filleting industry owing to a higher fillet yield, etc**. (Wathne, 1995*).*** The quality of farmed fish has occasionally been reported as being lower than that of wild fish **(Sylvia** *et al.***, 1995).** Although, contradictory result have also been obtained **(Jahncke** *et al.***, 1988). Hernandez** *et al***., (2001*)*** reported that wild fish acceptability is greater than that of farmed fish.

The term fish quality is all encompassing and its study is difficult owing to the fact that specific parameters that are recognized as being vital in one part of the world are judged to be less important elsewhere. Salmonid aquaculture has focused for many years on enhancing the quantity of fish produced. However, optimization of the quality of salmonids may lead to improve consumer acceptance and higher price for the farmed product **(Rasmussen, 2001).**

The quality of fish is affected by parameters such as feed type, level of dietary intake and growth. Feed composition has a major influence on the proximate composition of salmonids. In particular, whole body lipids as well as the lipid content in the edible fillet are directly related to dietary fat content, while the fatty acid composition of the fish flesh is also strongly influenced by the dietary fatty acid profile. Fish body composition appears to be largely influenced by feed composition. An increase in other parameters such as feeding rate and fish size also result in enhanced adipose deposition and decrease water content in the fish body. The protein content, however, remains more or less stable. An increase in body fat content is generally accompanied by reduction in slaughter yield, owning to an increase in the weight of viscera in relation to body weight. The levels of proximate constituents in the whole body as well as the fillet are readily manipulated by feed composition and feeding strategies, whereas the sensory parameters are less affected by these variables. Different rearing systems generate products having variable quality level which differ from wild fish in color **(Svàsand** *et al***., 1998; Favalora** *et al.***, 2002 and Flos** *et al***., 2002).**

Although fish quality is of prime importance for both the aquaculturist and consumer, few works has been conducted on the quality of farmed and wild fish. **Rueda** *et al. (***1997)** studied the quality of white muscle from wild and reared red porgy *(Pagrus pagrus)***.** They found that the fat percentage was higher in reared (3.35 ± 0.57%) than wild fish (0.65 ± 0.03%), and the fatty acids pattern of reared porgy selected the diet's lipid. These results were confirmed by **Orban** *et al.* **(2002).** They found that farmed sea bass had a total lipid content (10.57 ± 0.17 g/100g) which is significantly higher ($P \leq 0.001$) than wild fish (1.78 ± 0.01 g/100g), and fish from either productive systems showed comparably high total polyunsaturated fatty acids level.

**Grigorakis** *et al***. (2002)** studied major quality parameters, such as muscle composition and external appearance in wild and cultured gilthead sea bream. Their results showed that muscle fat content and total deposit fat (peritoneal and perivisceral fat) indicated a seasonal variation with minimum values observed in late spring and maximum in late summer. Lipid content of cultured sea bass was much higher than that of wild fish. Differences were also observed in fatty acid profile as well as the external appearance of fish. Also, the quality of lipid fractions of wild and farmed sea bass and gilthead sea bream was investigated by **Orban** *et al***. (2003).** Their results showed that reared fish of either species had total lipid content significantly higher than that of the wild. Gas chromatography of the total lipids revealed differences between the fatty acid profile of wild and reared fish. Also, the cholesterol levels were higher in wild fish.

**Johnston** *et al.* **(2006)** showed that fillet firmness and other muscle characters that are important for flesh quality were assessed in populations of wild and farmed Atlantic salmon *(Salmo salar)*. The authors found that fillet firmness was significantly greater for the wild than farmed fish, indicating a firmer texture in the wild fish. Farmed fish had around 650.000 fibers per trunk cross-section. Thus, differences in fillet texture and color between these populations could not be explained by the muscle cellularity which was similar between groups. Collagen concentration (alkaline-insoluble) was higher in wild than farmed salmon, whereas alkaline-soluble was 5.2 fold higher in farmed than wild salmon , the alkaline-insoluble collagen fraction is thought to be enriched with reducible and non-reducible cross-linked collagen. It was hypothesized that the higher average values of firmness in the wild than farmed salmon flesh can in part be attributed to higher concentrations of reducible immature collagen crosslink.

**Periago** *et al***. (2005)** studied the muscle cellularity and quality parameters of the flesh of wild and farmed sea bass *(Dicentrarchus labrax).* They found that muscle cellularity (as evaluated by the number and diameter of muscle fibers, as well as the muscle fiber size distribution throughout the total cross section of the flesh) differed among both groups, and muscle fiber density was higher in wild fish. All texture properties were significantly higher in wild than in farmed fish, all of them show a positive and significant correlation with muscle fiber density, pH, hydroxyl-proline and collagen contents. No relationship was found between muscle cellularity and nutrients composition of the sea bass. Also, farmed sea bass showed a high content of moisture and protein and lower flesh pH, and hydroxyproline and collagen contents. Saturated and monounsaturated fatty acids were significantly higher in farmed than in wild sea bass, whereas wild fish showed a higher content of polyunsaturated fatty acids.

The influences of rearing systems on the quality of fish were investigated. **Mairesse** *et al***. (2005)** studied the quality of wild and farmed perch *(Terca fluviatilis)*, using the morphometric, technological and color descriptors. Two different natural systems (Lemon Lake) and the (Rhine River) were selected to characterized per quality variability. Farmed per quality was studied in relation to the rearing systems (extensive, semi-intensive, and intensive). The results showed that the body and caudal fin, large mouth and head hand possessed a more reddish caudal fin in comparison to fish from Lemon Lake that are brighter. The intensive rearing system produced perch with higher hepatosomatic index and perivisceral fat index compared with the extensive and semi-intensive rearing systems. Moreover, the more intensive rearing conditions were, the more fat deposits increased. It was also found that reared perch possessed wild-like quality characteristics, except for some technological variables. Furthermore, perch from the semi-intensive system had the most similar quality attributes with fish from Rhine River.

The effect of finishing extensive farming period, to reduce fat content and manipulate the fatty acid profile of fish muscle was evaluated in rainbow trout by **Turchini** *et al.* **(2004).** Fish were stocked at artificial lake, in which fish were fed only on naturally available nutrients with no supply of artificial feed, for different lengths of time from 0 to 120 days. The results showed that the total fat content of fillets decreased considerably from 4.7 ± 0.6% at the beginning to 2.4 ± 0.4% and 0.7 ± 0.2% after 45 and 120 days respectively. Fillet fatty acid composition was affected by the time of stocking in the extensive farm. The extensive culture system seems to be a potentially useful tool for increasing the general quality of the end product.

Fish culture in Egypt has been developed into a major industry, and Nile tilapia (*Oreochromis niloticus*) is one of the major cultured species, since the quality of farmed tilapia is of prime importance for the consumer.

Therefore, the present work will be focused on studying the morphometric and meristic characteristics of cultured and wild Nile tilapia *Oreochromis niloticus* collected from Fish farm, Lake Edku, River Nile and Lake Manzalah. Also, dressing and chemical composition of both cultured and wild Nile tilapia were recorded. In addition, DNA fingerprint of different populations was carried out.

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