Improvement of Nile Tilapia (*Oreochromis niloticus*) Flavor to Increase Consumption

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Figure 1: The aquaponics research group filleting tilapia

Introduction

As the world faces decreasing fish populations due to global warming and over-fishing, there is a steady demand for fish (Naylor, Rosamond *et. al.* 2000). The Bahamas food supply is dependent on imports of food that are not only expensive, but have negative impacts on the environment such as: packaging, transportation, and production. A possible solution for over-fishing oceans is the rearing of fish. Aquaponics is a sustainable recirculating system that divides into two sections; hydroponics and aquaculture. (Rakocy et all. 2006). Aquaponics is a solution to both farming vegetables in challenging environments and to over-fishing.

Nile tilapia or *Oreochromis niloticus* (Figure 2), a member of the Cichlid family of fish, are commonly raised in aquaponic systems due to their ability to tolerate living in a small confined spaces with other fish. All tilapia are tolerant to brackish water however, Nile tilapia is the least saline tolerant (Pompa and Masser 1999). Although there have been studies about the impact of purging, or not feeding fish for a period of time to remove harmful chemicals in their lipids, Nile tilapia, there has not yet been research conducted on salt finishing to improve the overall flavor of the fish. Salt finishing is when the tilapia is placed into a salt bath. The purpose of the research at The Island School and Cape Eleuthera Institute was to determine the effects of purging tilapia, while finishing them in different salinity concentrations, on the flavor profile of the fish. We hypothesize that if tilapia are finished in a higher salt concentrations then the fish will have an improved over-all flavor.

Figure 2: Nile Tilapia

Methods

Two experiments were completed in two-week periods at the Cape Eleuthera Institute (CEI) in Eleuthera, The Bahamas.

- Sixteen tanks were randomly organized using Microsoft Excel 2007.
- The tanks (shown in Figure 3) were filled with four different salinity levels using ocean water and collected rain water from CEI: 0ppt, 10ppt, 20ppt, and 35ppt.
- Forty-eight fish of different sizes were caught randomly from CEI's aquaponics system.
- Each fish was weighed and randomly placed in individual tanks based on the different salinity levels.
- Twice a week the salinity levels were measured using an YSI 85 oxygen conductivity salinity and temperature instrument, pH levels and temperature was measured using an Ecosense pH10 meter, dissolved oxygen levels were measured using an YSI 55 Dissolved Oxygen instruments, and ammonia levels were checked using Smart2 Colorimeter made by LaMotte.
- The fish were harvested by being placed in ice-water baths, filleted (as seen in Figure 1), homogenized, and frozen at -20 degrees Celsius until they were ready to be sampled.
- The fish were cooked in a microwave for approximately four minutes until the meat was cooked through. One teaspoon of each fish sample was placed into individual tasting cups.
- Taste testers were randomly selected. Each taste tester sampled 9 cups and filled out a survey on their findings
- Then the data was entered into an Anova test through a program called Systat.

Figure 3:Tank Positions. Numbers represent different salinity levels and letters represent sample groups.

Discussion

The goal of this experiment was to find a way to make Tilapia taste better using a purging time of 2 weeks and finishing the fish in different salinity levels. It was hypothesized that the higher salinity level the Tilapia was purged in would cause the fish to have less of a musty flavor, which is the flavor that causes the Tilapia to have their off putting taste. The data collected from the first and second surveys administered was put through and ANOVA statistical test using Systat and it was found that the data collected was not significant. When comparing the results of the intensity of the salty flavor between the first and second survey, it was revealed that the data was no consistent, however when comparing the first and second survey while looking at the intensity of the musty flavor the data was consistent, but not significant. This was evident in the P value being greater than 0.05. It has been concluded that higher mortality rates in salt water suggest a benefit to finishing fish in fresh water. The data did not prove that purging and then finishing fish in a higher salinity level would improve the overall flavor of the fish.

Aquaponics is a practical answer the problem of overfishing in the Bahamas. Because there was a trend towards our data being significant when looking at musty and salty flavor it has been hypothesized that if the experiment was replicated on a larger scale the results could become statistically significant. In further studies, tests should be completed to see if different purging times mixed with different salinity levels would cause the Tilapia to taste better. Having tilapia taste better would increase how appealing it is to market consumers and consequently decrease overfishing.

Results

An Anova test was run on the data through the program Systat. It was found that the data collected was not statistically significant however there are trends towards the data being significant

Figure A

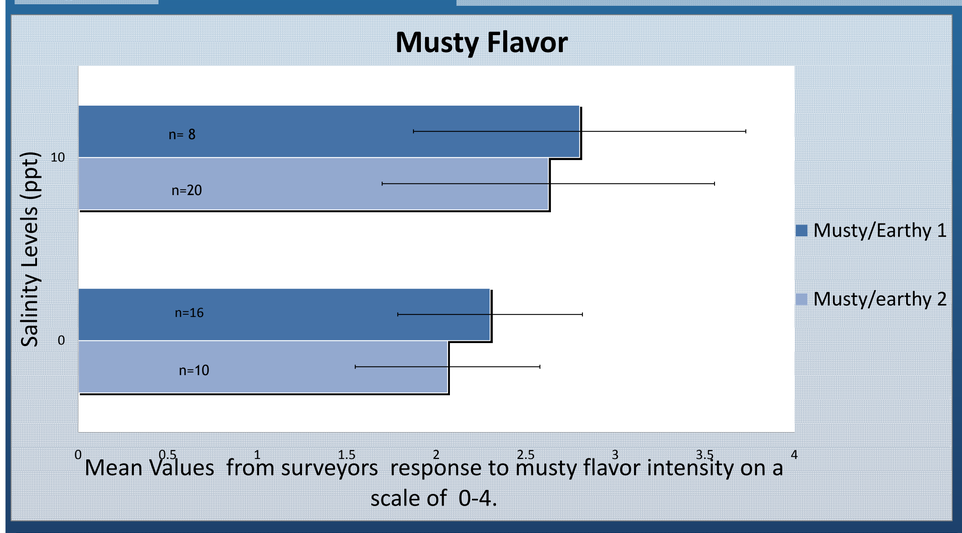

Figure A: Shows the comparison of the first and second survey when looking at musty flavor. Tilapia purged in 10ppt had a greater intensity of musty flavor

Figure B

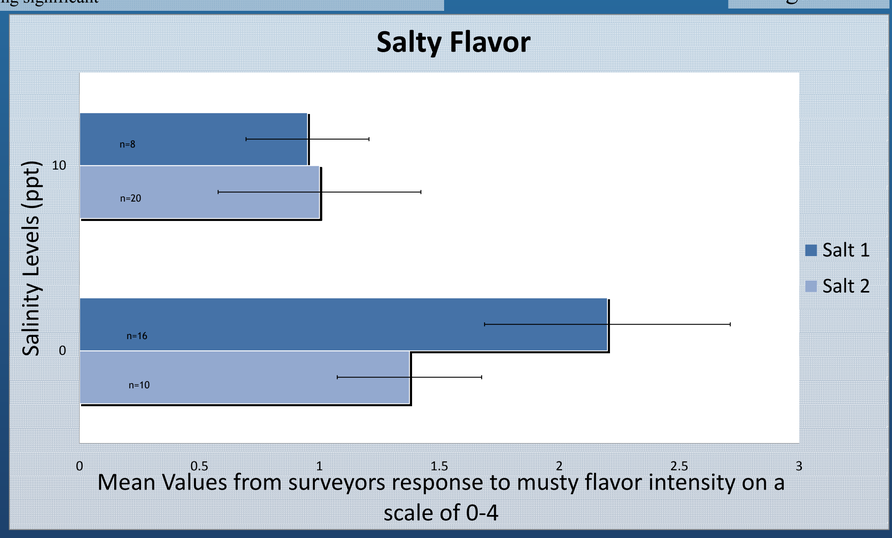

Figure B: Shows the comparison of the first and second survey when looking at musty flavor. Tilapia purged in 10ppt had a greater intensity of musty flavor

Literature Cited

Drake, S.L. et.al. 2009 "The effect of purging time on the sensory properties of aquacultured southern Flounder (paralichthys Lethostogma)." Journal of Sensory Studies 25:246-259

Guttman, Lior and Rijn, Jaap van. 2008. "Identification of conditions underlying production of geosmin and 2-methylisoborneol in a recirculating system." Elsevier 279:85-91

Hena, Abu *et al*. 2005. "Salinity tolerance in superior genotypes of tilapia, Oreochromis niloticus, Oreochromis mossambicus and their hybrids." *Aquaculture* 247: 189-201.

Palmeri, Girgio. et. al. 2007. "Biometric, nutritional and sensory changes in intensively farmed Murray Cod following different purging times." Food chemistry 107: 1605-1615

Pompa, Thomas *et Il.* 1999. "Tilapia Life History and Biology." *SRAC Publications*: 283.

Rakocy, James E. *et al.* 2006. "Recirculating Aquaculture Tank Production Systems: Aquaponics—Integrating Fish and Plant Culture." *SRAC Publication:* 454.

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