DESIGN, CONSTRUCTION AND VISUAL ASSESSMENT OF OFFICE FISH AQUARIA ON KOGI STATE UNIVERSITY ANYIGBA

Supported by tetfund
TERTIARY EDUCATION TRUST FUND

ADAH, P. M., ONIMISI, M. M., SALIU, U., SHEHU, B. RAIGBEMI, I. E., AND LAWAL, Y. M.
DEPARTMENT OF FISHERIES AND AQUACULTURE, KOGI STATE UNIVERSITY ANYIGBA
Corresponding author's email: adahphilip0@gmail.com or adah.mp@ksu.edu.ng

Received: June 28, 2024 Accepted: August 25, 2024

Abstract: This research was conducted on design and construction of fish aquaria in Kogi State University, Anyigba, Kogi State, Nigeria. Four aquaria (A, B, C and D) were constructed from carefully selected materials. Twenty respondents visually accessed the aquaria based on their level of construction error: with four different light background effects: White Light (WL) fixed in aquarium A, Blue Light (BL) fixed in aquarium B, White and Blue Light (WBL) fixed in aquarium C and No Light (NL) fixed in aquarium D: four different flower arrangements, Short Green Flowers (SGF) fixed in aquarium A, Short Pink Flowers (SPF) fixed in aquarium B, Long Green and Short Pink Flowers (LGSPF) fixed in aquarium C and Short Green with Short Pink Flowers (SGSPF) fixed in aquarium D, were displayed and four fish species Carassius auratus, Tilapia zilli, Oreochromis niloticus, and Synodontis multipunctus were introduced into the aquarium (ABCD) respectively. In term of construction Aquarium (A) was the best with 45%. In terms of different light background effects Aquarium C with white and blue light effect was the most attractive to respondents (70%). Aquarium C with long green and short pink flowers is the most attractive on different flower arrangement (70%). Fish species, Carassius auratus was more attractive (50%), Tilapia zilli (25%), Synodontis multipunctatus (15%) and Synodontis granusus (10%).

Key Words: Aquaria, construction, design, fish, Office,

Introduction

The term aquarium, coined by English naturalist Philip Henry Gosse, combines the Latin root aqua, meaning 'water', with the suffix -arium, meaning 'a place for relating to' (Brittsan and Jones, 2018) An aquarium (plural: aquariums or aquaria) is a vivarium of any size having at least one transparent side in which aquatic plants or animals are kept and displayed. The Aquarium is an artificial pool for keeping life aquatic animals and plants for ornamental, research and breeding purposes (Penning *et al.*, 2019). Fish keepers use aquaria to keep fish, invertebrates, amphibians, aquatic reptiles, such as turtles, and aquatic plants. (Katherine, 2018).

The idea of keeping fish in glass aquariums originated after 300 BC when glass was invented. During the Ming dynasty (1368 - 1643), the Chinese were entertained with goldfishes kept in earthen and glass vessels (Peterson, 2018). According to Smith *et al.*, (2014), today, many homes and public arenas have aquaria made not only of glass but also of Perspex or Plexiglas. The inventions of heaters and thermostats, aerators and biodisc have allowed more exotic fishes to be kept. The aquarium also has in it gravel, sand and rocks, which provide an artificial favorable environment to aid fish and plants survival as well add to the aquarium scenic beauty of environment. An 18 gallon rectangular tank aquarium of size 60 x 30 x 38 cm is the most suitable size for home (Thoney, 2020). The building of aquaria either for ornamental, research and breeding purposes has provided many beneficial values, and today, without a professional's touch, many have been able to create and manage their own aquaria and earn from it like the entertainment industry have done (Tlusty *et al.*, 2013). The design and construction of aquaria also has to do with the building of aquaria of high safety and economic values with quality materials in accordance with recognized standards and individual taste (Tlusty *et al.*, 2013). Small aquariums are kept in the home by hobbyists. There are large public aquariums in many cities. Public aquariums keep fish and other aquatic animals in large tanks. A large aquarium may have otters, turtles, dolphins, sharks, and whales. Most aquarium tanks also have plants (Alencastro *et al.*, 2015). According to Baquero (2019), an aquarist owns fish or maintains an aquarium, typically constructed of glass or high-strength acrylic. Cuboid aquaria are also known as fish tanks or simply tanks, while bowl-shaped aquaria are also known as fish bowls. Size can range from a small glass bowl, a few liters in volume, to immense public aquaria of thousands of liters. Specialized equipment maintains appropriate water quality and other characteristics suitable for the aquarium's residents (Baquero, 2019). This research will be a contribution to the body of literature in the area of aquarium design, construction and decoration of aquarium, thereby constituting the empirical literature for future research in the subject area.

Materials and Methods

Study Area

This project was carried out at the Department of Fisheries and Aquaculture Laboratory, Faculty of Agriculture, Kogi State University, Ayingba, Kogi State, Nigeria. Latitude 7.4858^0N, 7.1874^0E

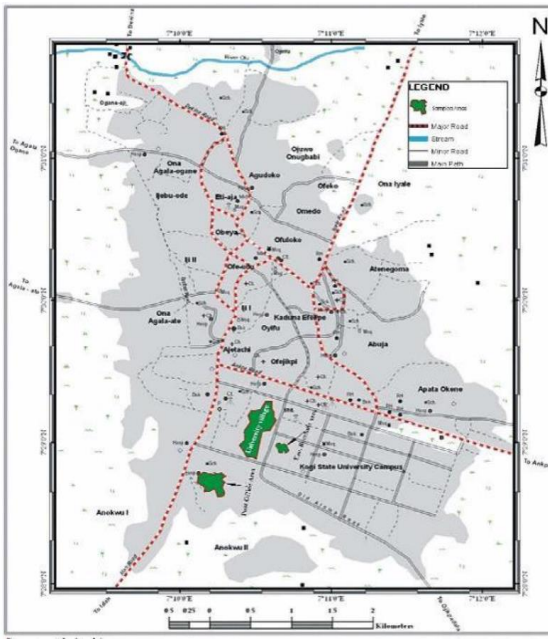

Figure 1: Map of Dekina showing Kogi State University, Anyigba

Source; Geography and Planning Department, Kogi State Audu University, Anyigba

Selection of materials for construction

Materials for construction of the aquarium were gotten from Aquatech Aquarium company, Ikeja, Lagos. The materials include; Wooden frames, Glass sheets, Silica gum, Roller, Light Emitting Diode (LED light), Aquarium sediment, Aquarium substrate, Ornamental plants, Aerators, Aeration pipes, Air stones, Spread spoon.

System of operation

Revolving desktop 360 degree fish tank with glass square jar (small betta fish tank aquarium) for office decoration. Overhead frame with blue and white LED light.

Major components used

The major components used includes tank; Aquarium Stand or Frame; Air Pump; Air Stone; Aquarium Substrate; Light Emitting Diode (LED Light); and Sub-sand Filter.

Construction of Office fish aquarium
Materials and Tools Needed

The materials used includes 4 inch thick glass sheets of dimensions: one piece bottom; 20cm by 20cm, two pieces (sides); 30cm by 20cm, two pieces (front and back); 30 by 20cm, a tube of silica gum, a frame with 360^0 roller, a stand and an overhead ceiling for the led light, led light emitting blue and white light alternatively, seal tape, towels, sponge, soap, water, cartons or news papers (larger than the tank bottom), grease for cleaning excess gum, razor blades, cotton wools, aesthetic plants, sediment, substrate and aerators (interior properties).

Sealing the Glass

The edges of all pieces of glass were cleaned with cotton dabbed in alcohol which was allowed to dry sufficiently. A large rectangular piece of paper was placed flat on the table. The paper was to prevent the aquarium from being glued to the table top. The bottom of the aquarium was carefully placed on the paper. Along only one of the long edges of the bottom run a strip of silicon glue. The glue was applied smoothly and evenly. There was no need to use a whole lot, but it was important to have glue along the entire edge and then watched for small dry spaces produced by air bubbles in the tube of silicon sealer. The front piece was taken carefully and placed on the edge of the glued edge of the bottom. It was pressed down firmly, not forcefully. The front piece of glass was braced with a bucket, heavy box or some other sturdy object while the work continued. A strip of sealer was runned along the top edge of both ends of the bottom piece of glass and also along the inside edges of the front piece. Then both sides were placed, one at a time, on top of the glue at the ends and pressed firmly. Two pieces of tape at either end were used to hold the two sides to the front while it continued. A strip of glue was runned along the top edge of the bottom and along the outer edges of the side pieces. The back glass was carefully placed on top of the glue that's along the bottom and against the glue along the side pieces and pressed firmly. Two pieces of tape were put on each end. All edges was checked and made sure that they fitted squarely. The aquarium was allowed undisturbed for at least one day. This was to give it time to dry properly. After it was dried the aquarium was filled up to one inch from the top, with tap water. It was left overnight; the absence of leakages proved a successful construction of aquaria. It was moved only when it was empty. A hose was used to drain the water. The aquarium was dried with rags or kitchen towels. The excess silicon glue was trimmed away by using single edged razor blades to make the aquarium neater and more attractive. This was re-tested again by filling it with fresh water as before. After trimming and retesting all leaking areas were marked with a grease pencil, it was drained as described above dried thoroughly, and re-glue those areas that were marked. The aquarium was filled with fresh water as before and checked for leakages again.

Placing the Aquarium

The setting in which aquarium is also very important. The health of fish depends a lot on how much light and heat the aquarium receives. The tank was placed on a level structure away from direct sunlight. Drafts produce rapid drops or rises in temperature. This will cause stress and a lowering of resistance to disease. Exposure to direct sunlight can often cause an undesirable growth of algae and a possible unwanted temperature rise.

Cleaning the Aquarium

The bottom materials were cleaned outdoors not to make a mess in the laboratory. Part of the collected material was poured into a plastic bucket so that it filled the bucket no more than 1/3 full. The material was cleaned by flushing the bucket of material with fresh water from a garden hose. As the bottom material was flushed, dirt and organic debris floated to the top and flowed over the edge of the bucket with the water. This was part of the

cleaning process. When the water was cleared, it was drained out of the bucket and the bottom material was scattered out over a flat surface such as a table top, patio or the ground covered with a plastic sheet. The remaining bottom material was washed in this manner. The bottom material was allowed to remain out in the sun for at least one week. The bottom material was scattered where nothing will disturb it. While the bottom material was drying, the aquarium was being set up.

Decorations

To decorate the inside of the aquarium, rocks that are not porous were chosen. Porous rocks have small holes that may collect organic matter and allow small animals to hide. The small animals that hide in the spaces when they eventually died often pollute the aquarium.

Lighting

Fluorescent bulbs were used to illuminate the aquarium. Fluorescent light showed the animal's colours to the maximum and helped to promote green algae growth which is highly desirable. A combination of a Gro-lux or Sea-lux fluorescent bulb with a cool-white fluorescent bulb seemed to work best. The lights should be left on for at least twelve hours each day.

Heating

Most aquarium animals can live quite well in a temperature range of 70-75F (21-24C). The temperature of the water in the aquarium was within the tolerable range throughout the period. There was no use of heating element.

Data collection

Kogi State University Office fish aquaria were constructed and decorated with different aquarium components including ornamental fish species. The aquaria were four in number. Comparisons were done using questionnaire for each of the aesthetic components of the aquaria. The components that were compared are; construction finishing, light background effect, flower beauty and fish species beauty among the four aquaria. The comparisons were carried out by 20 respondents. The pictures of the aquaria, results and discussion of the aesthetic value comparison of different components of the aquaria are stated and discussed.

Visual assessment of constructed aquaria

Twenty respondents visually inspected and accessed the four aquaria based on the level of construction error of each. The result of the assessment is shown below Figures 1. Aquarium A has the best finishing with least construction errors having 45% (9 respondents); based on the assessment while aquarium D has the most construction errors. All the aquaria were made with quality materials in accordance with recognized standards and individual taste (Tlusty *et al.*, 2013). The finished products satisfied the description of aquarium by Brittsan and Jones, (2018); Katherine, (2018); Penning *et al.*, (2019) and Thoney, (2020). The idea of keeping fish in glass aquariums originated after 300 BC when glass was invented. The Chinese were entertained with goldfishes kept in earthen and glass vessels (Peterson, 2018). But today, many homes and public arenas have aquaria made not only of glass but also of Perspex or Plexiglas (Smith *et al.*, (2014). Nowadays specialized equipment maintains appropriate water quality and other characteristics suitable for the aquarium's residents (Baquero, 2019).

Visual assessment of aquaria light background beauty by the respondents

Four different light background effects were displayed in the four aquaria. White Light (WL) fixed in aquarium A, Blue Light (BL) fixed in aquarium B, White and Blue Light (WBL) fixed in aquarium C and No Light (NL) fixed in aquarium D. They were inspected and assessed by twenty respondents which indicated the most beautiful light effect. The result of the respondent's opinion is shown in Table (2). Aquarium C with white and blue light effect is the most attractive (70%) than aquarium with just one of the lights (15%) and aquarium with no light (0%) is the least attractive to people. but many species also have no preference (Pandy and Shukla, 2015).

Visual assessment of aquaria flower beauty by the respondents

Four different flower arrangements were displayed in the four aquaria. Short Green Flowers (SGF) fixed in aquarium A, Short Pink Flowers (SPF) fixed in aquarium B, Long Green and Short Pink Flowers (LGSPF) fixed in aquarium C and Short Green with Short Pink Flowers (SGSPF) fixed in aquarium D which were inspected and assessed by twenty respondents on the most beautiful flower combination. The result is shown in Table (3). Aquarium C with long green and short pink flowers is the most attractive (70%). Table (3) showed the aesthetic comparison of different flower or ornamental plant color and arrangement across the four aquaria. Based on the result from that table, the most beautiful flower combination is combination of long flowers and short flowers of different colors. People saw it to be better than the aquaria with short flowers. The flowers represent aquatic plants. Most aquarium tanks also have plants (Alencastro *et al.*, 2015). Tall aquatic plants are gaining widespread popularity among aquarium hobbyists for their attractiveness and broader leaves. Tall plants help create a roomier, natural-looking, and more intricate aqua scape as they hide the top of the tank and add a visual element you cannot achieve with short plants (Esther, 2018).

Visual assessment of aquaria fish species

Four fish species Gold fish Carassius auratus, Red belly tilapia Tilapia zilli , catfish Synodontis multipunctus and catfish Synodontis granusus were introduced into each of the aquarim. They were inspected and assessed by the respondents that indicated fish based on their aesthetic features. The result of the respondent opinion is shown in Table 4. Based on the respondents' assessment, Gold fish *Carassius auratus* was more attractive than all other fish species having (50%), 25% choose *Tilapia zilli*, 15% choose *Synodontis multipunctatus* and 10% choose *Synodontis granusus.* Gold fish (*Carassius auratus)* has better aesthetic characteristics than Red belly tilapia *Tilapia zilli*, *Synodontis multipuntatus* and *Synodontis granusus.* This was because gold fish *Carassius auratus*

had a long history in fish species used for ornamentation. Chinese were entertained with goldfishes kept in earthen and glass vessels (Peterson, 2018).

Figure1: Picture of Aquarium A

Aquarium A is composed of; white light background, Goldfish (Carassius auratus), short green flowers, an aerator, white substrate and sub sand filter.

Figure 2: Picture of Aquarium B

Aquarium B is composed of; blue light background, Red belly Tilapia (Tilapia zilli), short pink flowers, an aerator, white substrate and sub sand filter.

Figure 3: Picture of Aquarium C Cat fish (*Synodontis multipuntatus*)

Aquarium C is composed of; blue and white light background, Catfish (Synodotis multipuntatus) green flowers, short pink flowers, an aerator, white substrate and sub sand filter.

Figure 4: Picture of Aquarium D

Aquarium D Cat fish (Synodontis granusus)

Aquarium D is composed of; no light background, Catfish (Synodotis granusus) short green flowers, short pink flowers, an aerator, white substrate and sub sand filter.

Table 1: Visual assessment of Aquaria finishing

Parameters	Number of respondents	Percentages (%)
Aquarium A	9	45
Aquarium B	6	30
Aquarium C	4	20
Aquarium D	1	5
Total	20	100

Table 2: Visual assessment of the light background effects of the Aquaria

Parameters	Number of respondents	Percentages
Aquarium A (WL)	3	15
Aquarium B (BL)	3	15
Aquarium C (WBL)	14	70
Aquarium D (NL)	0	0
Total	20	100

KEY

WL = White Light

BL = Blue Light

WBL = White and Blue Light

NL = No Light

Table 3: Visual assessment of flower beauty in the Aquaria

Parameters	Number of respondents	Percentages
Aquarium A (SGF)	3	15
Aquarium B (SPF)	2	10
Aquarium C (LGSPF)	14	70
Aquarium D (SGSPF)	1	5
Total	20	100

KEY

SGF = Short Green Flower

SPF = Short Pink Flower

LGSPF = Long Green Short Pink Flowers

SGSPF = Short Green Short Pink Flowers

Table 4: Visual assessment of fish species beauty in the Aquaria

Parameters	Number of respondents	Percentages
Aquarium A (Gold fish, Carassius uaratus)	10	50
Aquarium B (Red belly Tilapia Tilapia zilli)	5	25
Aquarium C ((Catfish Synodontis multipuntatus	3	15
Aquarium D (Catfish Synodontis granulosus)	2	10
Total	20	100

KEY

Aquarium A = Carassius uaratus

Aquarium B = Tilapia zilli

Aquarium C = Synodontis multipuntatus

Aquarium D = Synodontis granulosus

Conclusion

The study revealed that different component of an aquarium has effect on the people viewing it. The main aim behind aquarium construction is for aesthetic purpose and the components have to be carefully selected and properly combined to give the beauty that will interest viewers and be therapeutic to people. The best aquarium components based on this research are coloured lights especially blue because it gives an underwater impression and white lights are also beautiful as it exposes the detail of everything in the aquarium. However, white and blue light combinations have the best effect as it showed the details with white light and gave an underwater impression with the blue light. The ornamental plants that are longer had better aesthetic value and therapeutic effect than short flowers as the long flowers makes it look more similar to the natural environment than short flowers. Gold fish has better ornamental characteristics than all the fish species. It was more active, have attractive color than all the fish in the aquarium. Generally, the fish in the aquarium with the best components combination was the most active fish; it fed better and grew faster than the others making the aquarium even more interesting to view. Also, when constructing an aquarium, one should avoid construction errors as much as possible by ensuring accuracy in every measurement taken. Every error in construction will have an effect in the overall look of the aquarium when it is completely set up. Aquaria design and construction require expertise which few teams around the world are trying to provide. It has evolved into a niche industry of ISnternational recognition and standard though provided

by those few teams involved. You can purchase or create your own aquatic garden with the basic knowledge of aquaria design, construction and proper management of the system.

References

Alencastro LA., Degner LR,, & Larkin SL. 2015. Hobbyists' preferences for marine ornamental fish: A discrete choice analysis of ecolabeling and selected product attributes. Live Reef Fish *Information Bulletin*, vol. 15, 19–22.

Baquero J 2019. Marine Ornamentals Trade, Quality and Sustainability for the Pacific Region. South Pacific Forum Secretariat Trade and Investment Division, Suva, Fiji.

Esther JJV. 2018. Encyclopedia of Tropical Fish. Edn 2, Rebo Productions Ltd. The Netherlands.

Jones R. 2018. Corals and customs: The international trade in wild coral. In: Advances in Coral Husbandry in Public Aquaria. *Burgers' Zoo, Arnhem*, The Netherlands, pp. 351–361.

Katherine CG. 2008. "Pets in America: A History". University of North Carolina Press, pp 53

Pandy K and Shukla JP 2015. Fish and fisheries. National Offset Printers, Meerut, 461-473.

Patrick PG., Matthews CE., Ayers DF., and Tunnicliffe SD. 2017. Conservation and education: Prominent themes in zoo mission statements. *Journal of Environmental Education*, vol. 38:53–60.

Penning M., Reid G., Koldewey H., Dick G., Andrews B., Arai K., Garratt P., Gendron S., Lange J. and Gibson C. 2019. Turning the Tide – A Global Aquarium Strategy for Conservation and Sustainability. *World Association of Zoos and Aquaria*, Bern Switzerland.

Petersen D. 2018. The role of sexual reproduction in captive population management – a review. In: Advances in Coral Husbandry in Public Aquaria. Burgers' *Zoo, Arnhem*, The Netherlands, pp. 319–323.

Smith M., Warmolts D., Thone, D. and Hueter R. 2014. The Elasmobranch Husbandry Manual: Captive Care of Sharks, Rays and their Relatives. *Special Publication of the Ohio Biological Survey*, Columbus, United States of America.

Thoney D 2020. Aquarium Collection Sustainability Planning for the Future. *Regional Aquatics Workshop*, Henry Doorly Zoo, Omaha, United States of America.

Tlusty MF., Rhyne AL., Kaufman L., Hutchins M., Reid GM., Andrews C., Boyle P., Hemdal J., McGilvray F. and Dowd S. 2013. Opportunities for public aquariums to increase the sustainability of the aquatic animal trade. *Zoo Biology*, 32, 1–12