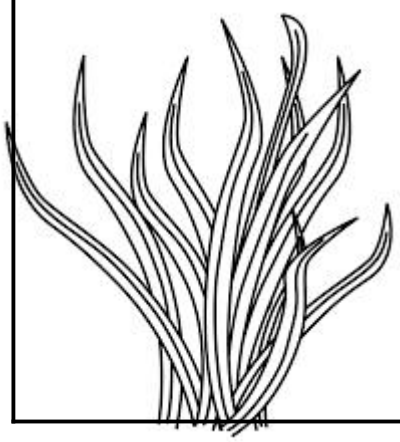
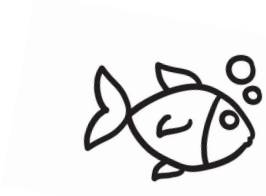
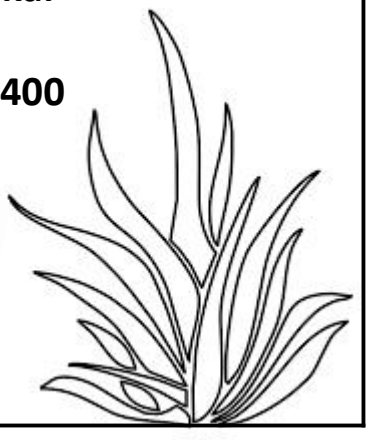
REPORT ON INTERNSHIP AT THE ENERGY AND RESOURCE INSTITUTE (TERI)

Name: Mugdha D. Chodankar
Class: Msc Part II
Seat No: 21P04400







Introduction

As a part of the syllabus, an internship was carried out at The Energy and Resource Institute (TERI), St. Cruz, Panaji during the month of December. I along with some of my friends were placed at The Energy and Resource Institute (TERI) for the internship that was carried out for a period of one month.

The TERI Office in Goa was set up in the year 1996 and it aims at policy research in the interface between environment and development. This Institute also have TERI Coastal Education Hub which is located at Goa Velha.

Objectives:

1) Formulation of Aqua feed using Whole algae and De-oiled algae.
2) Conduction of a feeding experiment and comparison of growth of fishes with formulated fish feed and Growel fish feed.
3) To set up a small scale Aquaponics setup.

Aqua feed Preparation

A total of three different diets were prepared i.e Diet 1a, Diet 1b and Diet 2. Each Diet consists of varied amounts of ingredients as follows:

Diet 1a : De-oiled Algae, Wheat Bran, Ground nut oil cake, Vitamins and Minerals, Binder and Fish meal.

Diet 1b : De-oiled Algae, Wheat Bran, Ground nut oil cake, Vitamins and Minerals, Binder and Fish meal.

Diet 1a has different amount of Deoiled Algae as compared to Diet 1b.

Diet 2 : Whole Algae, Wheat Bran, Ground nut oil cake, Vitamins and Minerals, Binder and Fish meal.

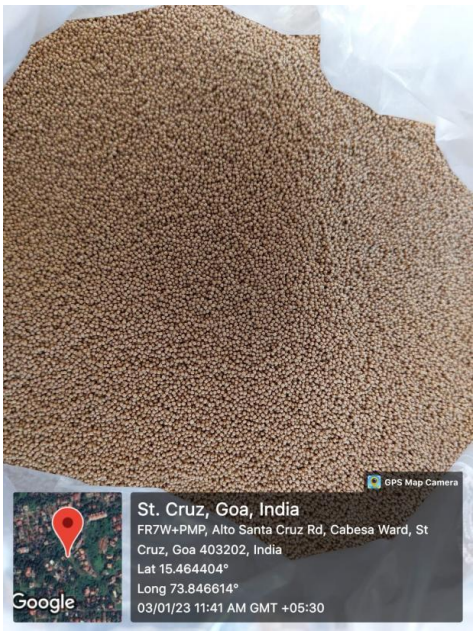
Control Diet : Growel was given as Control feed.

All the ingredients of a particular diet were weighed according to concentrations provided and mixed thoroughly to make a dough by adding some warm water. This dough was uniformly spread on the tray and kept for sun drying. It was flipped after every 30 minutes until it was completely dried and there was no moisture present. This dried feed was powdered using a mixer and was then stored in airtight containers.

Mixing ingredients to make Aqua feed dough

Flipping of Aqua feed while kept for drying

Diet 1a, Diet 1b and Diet 2 along with filled vials



Control Diet - Growel

Aqua feed Analysis

The analysis of all the Fish Feed was carried out in the laboratory. Biochemical Tests like estimation of Carbohydrates and Proteins was carried out along with estimation of Moisture content of the Aqua feed.

Procedure for Aqua feed Analysis

a) 5g of Aqua feed of each diet was taken.
b) It was homogenized using 10ml of distilled water.
c) The feed was centrifuged at 3000 rpm for 15 minutes.
d) The supernatent was used for the analysis of Carbohydrates and Proteins.

Carbohydrate Analysis

i. 1ml supernatent of each diet was taken in a test tube.
ii. 5ml of Anthrone reagent was added to each test tube.
iii. All the test tubes were kept in boiling water bath for 15 minutes.
iv. Optical density of all was taken at 620 nm.

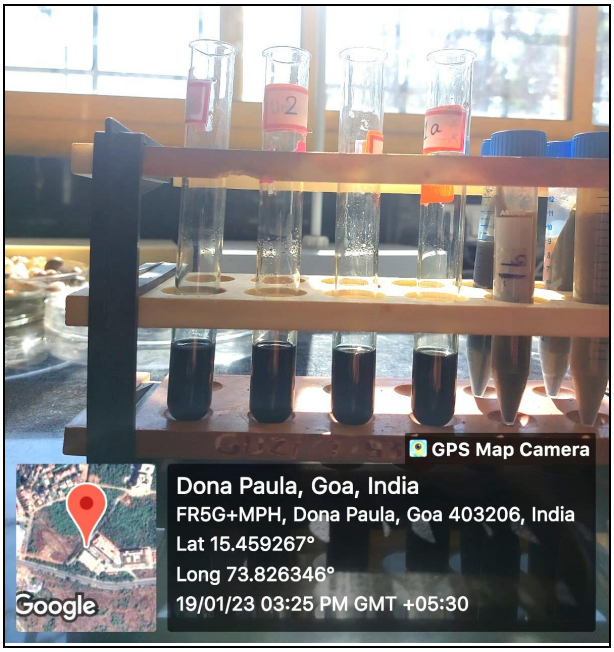
Protein Analysis

a. 1ml of supernatent of each diet was taken in a test tube.
b. 5ml of Lowry's reagent was added to each test tube and incubated at room temperature for 15 minutes.
c. Then, 0.5ml of Folin's reagent was added to each test tube and incubated at room temperature for 10 minutes.
d. Optical density of all was taken at 660 nm.

The optical density obtained was then substituted in standard equations and the concentration of Carbohydrate and Protein in each diet was calculated.

Moisture Analysis

i. The weight of empty crucible was taken.
ii. 1g of Aqua feed was measured and put into the crucible.
iii. The weight of crucible was taken again.
iv. The crucible was then kept in an oven for 1 hour at 105 ℃.
v. The crucible was weighed again after taking out from the oven.
vi. Moisture content was calculated according to the formula A-B/A x 100 where A is wet weight and B is dry weight.



Analysis of Feed

Result:

Aqua feed	Carbohydrate (ug/ml)	Protein (mg/ml)	Moisture content
Control	0.089	615.95	5.01 %
Diet 1a	0.090	624.68	2.40 %
Diet 1b	0.091	600.42	6.23 %
Diet 2	0.087	609.36	10.52 %

About 200 Tilapia fingerlings were purchased from Green Lake Farm, Majorda. The following steps were carried out before the fishes were transported in the tank:

a) The polythene bag containing the fishes was washed thoroughly externally.

b) A bucket was half filled with water followed by which the bag containing the fishes was inverted in the bucket and opened slowly to allow the fishes to come out in the surrounding water.

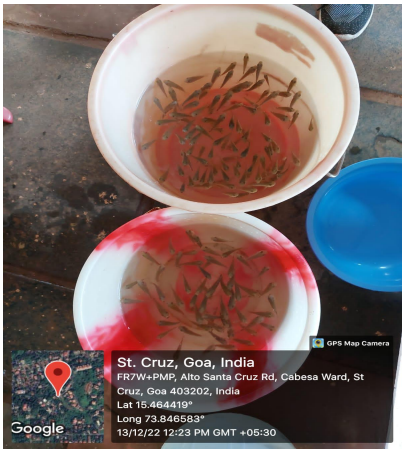
c) The fishes were then weighed using a bowl. The bowl was filled with water and kept on weighing scaled and tared. Then the fish was transferred in the bowl and the exact weight was noted.

d) The fishes were segregated in different groups according to their weights.

To carry out the experiment, 12 tanks were cleaned and filled with water. 3 tanks were considered for each diet. Biofilters and Aerators were also added into the tank.

Polythene bags containing fishes

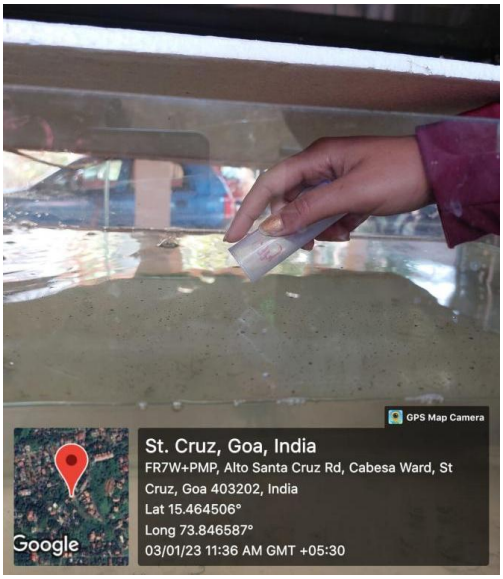
Fishes being emptied in bucket



Fishes being segregated in buckets

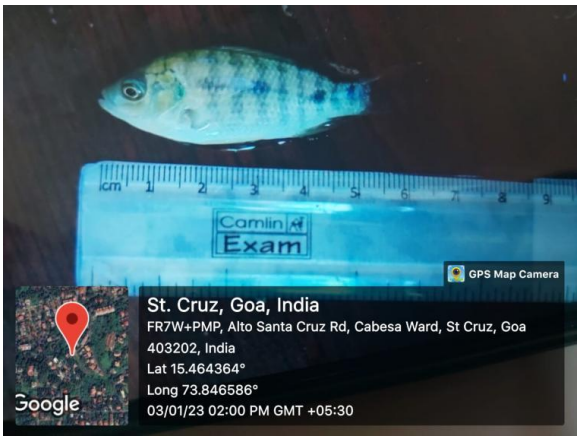
Day 0

6 fishes weighing around 1.5 - 2.5 g were added to each tank, so a total of 72 fishes were used for the Aqua feed Experiment. The diet plan was carried out for 14 days. All the fishes were fed with Growel on Day 0 and the experimental feed was given from Day 1. The Prepared feed was weighed as per the diet requirements of the fish being tested i.e 6% of total body weight of fish and filled in small vials which were fed everyday to the fish.



Feeding the fishes

On Day 7 and on Day 14, the weights and lengths of all fishes were measured.



Fish being weighed using weighing balance and its length is measured using ruler

Observations:

► Control Diet

Day 7

Tank 1			Tank 2			Tank 3	
Length (cm)	Weight (g)		Length (cm)	Weight (g)		Length (cm)	Weight (g)
5.5	3.29		6.0	2.62		6.1	4.55
6.0	3.30		6.5	4.91		6.1	5.02
6.6	4.49		6.0	4.20		6.8	4.42
6.0	2.00		5.0	3.28		7.2	5.72
5.6	2.90		6.0	3.88		6.2	4.80
5.9	3.35		6.0	1.75		5.9	4.12
Average	**3.22 g**		**Average**	**3.44 g**		**Average**	**4.77 g**

Day 14

Tank 1			Tank 2			Tank 3	
Length (cm)	Weight (g)		Length (cm)	Weight (g)		Length (cm)	Weight (g)
6.0	3.37		6.5	2.83		6.0	4.15
6.4	4.53		6.7	6.04		6.7	5.83
7.1	4.50		6.5	5.03		7.4	7.41
6.3	2.40		5.5	4.00		7.3	4.85
5.9	3.10		6.2	3.98		6.5	5.00
6.1	3.70		6.3	2.50		6.2	4.62
Average	**3.60 g**		**Average**	**4.06 g**		**Average**	**5.31 g**

► Diet 1a

Day 7

Tank 1			Tank 2			Tank 3	
Length (cm)	Weight (g)		Length (cm)	Weight (g)		Length (cm)	Weight (g)
6.0	1.61		5.5	2.73		6.5	4.95
6.0	2.40		5.8	3.04		6.2	4.01
6.0	3.64		5.5	2.65		6.6	5.00
6.1	1.97		5.4	2.44		5.6	2.84
6.0	1.61		6.0	2.72		6.5	4.32
6.0	2.00		5.6	2.65		5.5	2.68
Average	**2.20 g**		**Average**	**2.70 g**		**Average**	**3.96 g**

Day 14

Tank 1		Tank 2		Tank 3	
Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)
6.2	4.24	6.0	3.41	7.0	5.73
6.5	4.83	5.9	3.07	7.1	4.55
6.7	3.23	5.5	5.19	7.0	4.70
6.3	5.66	7.0	5.21	6.9	4.50
6.9	5.06	6.1	4.5	7.0	3.98
6.7	4.06	5.9	4.1	6.7	3.39
Average	**4.51 g**	**Average**	**4.24 g**	**Average**	**4.47 g**

► Diet 1b

Day 7

Tank 1		Tank 2		Tank 3	
Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)
6.3	3.91	5.5	2.96	5.9	3.70
6.2	4.60	5.5	2.75	6.0	4.01
5.5	2.66	5.0	2.27	6.0	3.44
5.4	2.63	5.0	2.41	6.0	2.97
6.3	3.44	5.5	2.85	5.8	3.24
5.8	3.63	5.5	2.60	6.2	5.64
Average	**3.47 g**	**Average**	**2.64 g**	**Average**	**3.83 g**

Day 14

Tank 1		Tank 2		Tank 3	
Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)
5.5	2.95	5.6	3.13	6.0	3.86
6.3	4.01	5.6	2.89	6.5	4.48
6.7	4.31	5.3	2.55	6.5	4.23
5.9	3.83	5.2	2.67	6.2	3.10
5.6	4.89	5.7	2.97	6.0	3.44
6.5	3.10	5.8	2.85	6.4	5.70
Average	**3.84 g**	**Average**	**2.84 g**	**Average**	**4.13 g**

► Diet 2

Day 7

Tank 1			Tank 2			Tank 3	
Length (cm)	Weight (g)		Length (cm)	Weight (g)		Length (cm)	Weight (g)
5.8	3.23		5.9	3.30		6.3	3.94
6.0	2.23		6.0	3.26		5.6	2.95
5.9	2.00		5.5	2.87		6.5	4.46
6.5	4.30		5.9	3.41		6.3	4.08
5.9	3.30		5.5	2.61		6.2	3.83
5.9	3.05		5.5	1.60		6.4	4.34
Average	**3.01 g**		**Average**	**2.84 g**		**Average**	**3.93 g**

Day 14

Tank 1			Tank 2			Tank 3	
Length (cm)	Weight (g)		Length (cm)	Weight (g)		Length (cm)	Weight (g)
5.9	3.30		6.0	3.95		6.5	4.62
6.4	2.34		5.9	3.50		5.7	3.34
6.2	3.03		5.7	3.01		6.7	5.24
6.7	4.50		6.0	3.60		6.5	4.20
6.1	3.57		5.9	2.98		6.4	3.98
6.0	3.20		5.9	2.10		6.5	4.51
Average	**3.31 g**		**Average**	**3.19 g**		**Average**	**4.31 g**

Aquaponics Setup

To make the Aquaponics Setup, all the group members initially referred and read many reference articles and came up with a simple and unique diagrammatic representation of the system. After finalizing the diagram, a list of all the required materials was made and these items were brought from nearby stores such as PVC Pipes, Aquarium air pump, rubber tubes, zip tags, end caps, hydroponic cups, silicone glue, hole saw set, m-seal, solvent cement, drill machine etc. The system was made as follows:

a) A metal stand was cleaned and placed near an electric point such that connection for Aquarium air pump is accessible.

b) Holes were then drilled in the PVC pipes according to the required size using a drill machine.

c) Pipes were fixed on the metal stand using zip tags in a zigzag manner.

d) Small holes were drilled in the end caps to pass the rubber tubes.

e) These end caps were fixed on the PVC pipes with the help of solvent cement.

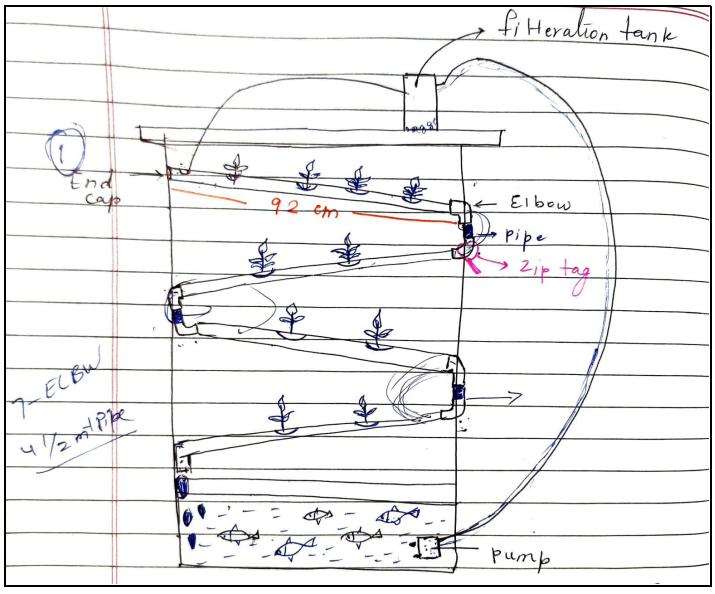
f) Rubber tubes were then passed through the holes and fixed using m-seal.

g) The last pipe was positioned in the tank for the clean water to come back in the tank.

h) A bio-filter having the ammonia converting bacteria was placed in the aquarium tank.

i) The ratio for placing Plants:Fishes in the Aquaponic system was mentioned in a research article as 2:1 thus, we placed 5 Tilapia fishes and 10 Plants.

j) The plants were placed in the Hydroponic cups such that their roots stick out through the holes beneath and expandable clay balls were used to support the stem.



Diagrammatic representation of Aquaponics Setup

Expandable Clay Balls

Aquaponics Setup

Conclusion

In the feeding experiment conducted, it was found that fishes fed with Growel feed showed a higher growth rate (weight and length) as compared to fishes with the experimental diet consisting of De-oiled and Whole algae. A small scale Aquaponics setup was built using easily available materials.

Learning Outcome

In this one month internship program, we learnt:
1. To formulate fish feed.
2. We attained skill on maintenance of tank, fingerlings and measurement of weight and length.
3. We also gained an experience on setting up of small scale Aquaponics system.

Group Members along with Dr. Fraddry D'Souza and Dr. Elroy Pereira