INTERNSHIP REPORT

Location- TERI (The Energy and Resource Institute)

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INTRODUCTION

The internship was part of our semester III aquaculture cluster. I along with six other students did my internship at TERI (The Energy and Resource Institute). TERI is an independent, multi-dimensional organization, with capabilities in research, policy, consultancy and implementation. It is headquartered in New Delhi, they have regional centres and campuses in Gurugram, Bengaluru, Guwahati, Mumbai, Panaji, and Nainital. The TERI office in Goa was set up in 1996 and aimed at policy research in the interface between environment and development. Over the years, it has gained expertise in the area of coastal and marine research, biodiversity mapping and water resource management. It promotes sustainability encompassing policy research, education, solutions at grassroots, and awareness generation. We did our internship under the Guidance of **Dr Fraddry D Souza** (Area Convenor, The Coastal Ecology & Marine Resources Centre) and **Dr Elroy Pereira** (Researcher).

The internship had 2 components

1. Aquafeed preparation
2. Aquaponics setup

OBJECTIVES

1.Formulation of fish 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.

1. AQUAFEED PREPARATION

This experiment was done under the guidance of Dr. Elroy Pereira. This experiment was done through following steps:

1. Diet formulation
2. Experimental setup
3. Maintenance
4. Weighing of fish
5. Feed plan

1.1 Diet formulation

The Aquafeed preparation experiment consisted of three diets and one control

Diet 1a – de- oiled algae ***Diet 1b*** – de- oiled algae ***Diet 2*** – whole algae

Control – growel feed

The percentage of all the ingredients taken are shown below in the table

Ingredients (%)	DIET 1	DIET 1 A	DIET 2
De- oiled algae	0.40	0.40	
Whole algae		0.40	0.40
Fish meal	0.1	0.25	0.1
Wheat bran	0.15	0	0.15
Groundnut oil cake	0.31	0.31	0.31
Vitamins and minerals	0.02	0.02	0.02
binder	0.02	0.02	0.02
Protein in diet (g/100g)	31.0417	36.0937	33.3977
Gross energy (g/100g)	240.8167	240.7427	255.2167

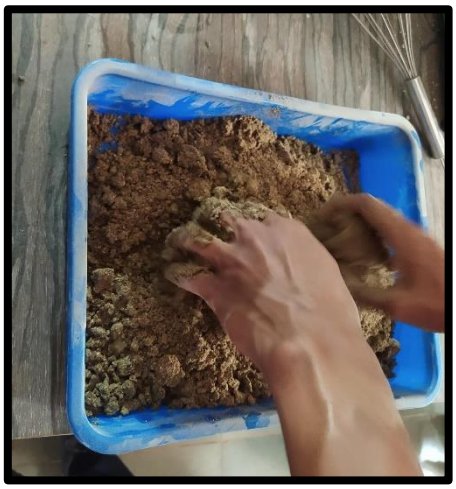
(All the values were multiplied by 1000 to get the quantity for 1 kg)

Feed was formulated to meet the requirements of fish fry/fingerlings incorporating de-oiled algae as a potential feed ingredient. Feed processing includes grinding, premixing, mashing, pelletizing, drying and packaging.

Feed ingredients such as de-oiled algae, whole algae, fish meal, wheat bran, vitamins and minerals, binder were already in powder form. Ground nut oil cake however was not, so it was powdered using a grinder. Wheat bran and fish meal were sieved and the ingredients were kept for drying in sun to get rid of moisture.

Drying of ingredients in the sun and sifting

Then all the ingredients were weighed according to the diet and mixed by hand before adding water. Each mixture was made into a dough by adding 100 ml of warm water a time.



Making a dough by mixing all the ingredients

The prepared dough

The dough was then spread on a tray to increase its surface area and then allowed to dry in sun. halfway through drying it was also flipped to allow the underside to dry.

It was then cut into pieces and further dried so that it dries through the cracks. The dried pieces were added in grinder and powdered. This **powder feed** was then used for the experiment to feed the fry/ fingerling

Dough spread on tray and kept for drying

Semi dried dough cut into pieces

Completely dried dough pieces

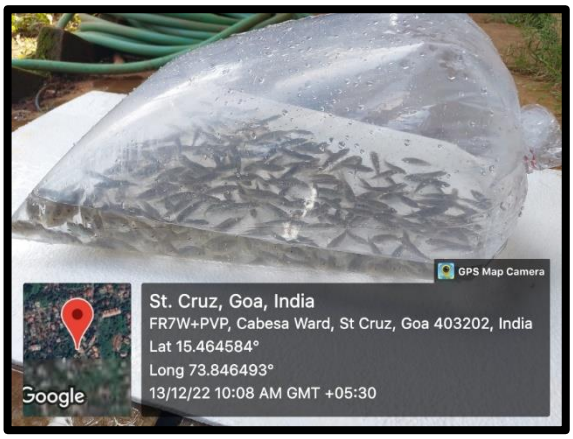
Diet 1a, 1b and 2 filled in vials

Growel feed

1.2 Experimental setup

Aquarium tanks placed on stands were cleaned and filled with clean water for the experiment, bio filters and aerators were added. About 200 tilapia fingerlings / seeds were purchased from green Lake farm Majorda along with growel fish feed.

Aquarium tanks used for the experiment



Tilapia seeds/ fingerlings in polythene bag

The following steps were carried out before the fishes what transported in the tank:

- The polythene bag containing the fishes was washed externally
- A bucket was half filled with water followed by which the bag was placed in the bucket and opened slowly allowing the fish to come out in the surrounding water

Polythene bag containing fishes placed in a bucket

Bag opened, allowing the fishes to come out in surrounding water

- The fishes were then weighed, to do this a bowl field with water was placed on the weighing machine and then tared, a single fish was then immersed in the bowl and then a weight was noted
- The fishes were segregated in three groups based on the weight of the fishes

Weighing of fishes

Tilapias Segregated in different buckets according to their weight

The fishes in group 1 were of 4 to 7 gram the fishes in group to were 3 to 4 grams and fishes in group three for 0.5 to 2.8 grams

Group 3 contained the largest number of fishes, from this group segregation was done again.

Fishes belonging in the range of 1.5 to 2.5 grams were only considered for the experiment and the fishes not in this range were rejected and put in another tank these fishes were not part of the experiment

Six fishes from the selected category were added in each of the 12 tanks and the rejected fishes for kept in two separate tanks

1.3 Feed plan

The tanks we labelled according to the diet plan
Three tanks were labelled for each diet.

The diet plan for the fishes was carried out for 14 days so according to the diet plan the vials were filled.
On day zero till day two, the Tilapias were only fed with Growel feed.

Fishes were fed according to according to 6% of the body weight
Each day the vials was fed to the fishes according to the weight and diet plan.
On day 7 the weight and the length of the fishes were measured and noted
It was observed that there was increase in the weight and the length of the fish so accordingly the diet plan for the fishes was also increased considering the weight gain.
Similar procedure was also carried out on day 14 to measure the length and the weight of the fishes the feed plan was again increased.

Measuring length of the fish with help of a ruler

Feeding the fishes

The weights and lengths of the fishes from day 0 to day 14 are noted below

Control (Growel feed)

Day 0 (fishes in the weight range of 0.5 g – 2.5g considered)

Day 7

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	5.5	3.29		6	2.62		6.1	4.55
2	6	3		6.5	4.91		6.1	5.02
3	6.6	4.49		6	4.2		6.8	4.42
4	6	2		5	3.28		7.2	5.72
5	5.6	2.9		6	3.88		6.2	4.8
6	5.9	3.35		6	1.75		5.9	4.12
Average		**3.22**			**3.44**			**5.77**

Day 14

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	6	3.37		6.5	2.83		6	4.15
2	6.4	4.53		6.7	6.04		6.7	5.83
3	7.1	4.5		6.5	5.03		7.4	7.41
4	6.3	2.4		5.5	4		7.3	4.85
5	5.9	3.1		6.2	3.98		6.5	5
6	6.1	3.6		6.3	2.5		6.2	4.32
Average		**3.6**			**4.06**			**5.31**

Diet 1a (De-oiled algae)

Day 0 (fishes in the weight range of 1.5g – 2.5g considered)

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	6	1.61		5.5	2.73		6.5	4.95
2	6	2.4		5.8	3.04		6.2	4.01
3	6	3.64		5.5	2.65		5.6	2.84
4	6.1	1.97		5.4	2.44		6.5	4.32
5	6	1.61		6	2.72		6.6	5
6	6	2		5.6	2.65		5.5	2.68
Average		**2.205**			**2.705**			**3.96**

Day 7

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	6	1.61		5.5	2.73		6.5	4.95
2	6	2.4		5.8	3.04		6.2	4.01
3	6	3.64		5.5	2.65		5.6	2.84
4	6.1	1.97		5.4	2.44		6.5	4.32
5	6	1.61		6	2.72		6.6	5
6	6	2		5.6	2.65		5.5	2.68
Average		**2.205**			**2.705**			**3.96**

Day 14

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	6.2	4.24		6	3.41		7	5.73
2	6.5	4.83		5.9	3.07		7.1	4.55
3	6.7	3.23		5.5	5.19		7	4.7
4	6.3	5.33		7	5.21		6.9	4.5
5	6.9	5.06		6.1	4.5		6.7	3.39
6	6.7	4.06		5.9	4.1		7	3.98
Average		4.51			4.24			4.47

Diet 1b (de-oiled algae)

Day 0 (fishes in the weight range of 1.5g – 2.5g considered)

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	6.3	3.91		5.5	2.96		5.9	3.9
2	6.2	4.6		5.5	2.75		6	4.01
3	5.5	2.66		5	2.27		6	3.44
4	5.4	2.63		5	2.41		6	2.97
5	6.3	3.44		5.5	2.85		5.8	3.24
6	5.8	3.63		5.5	2.6		6.2	5.64
Average		**3.47**			**2.64**			**3.83**

Day 14

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	5.5	2.95		5.6	3.13		6	3.86
2	6.3	4.01		5.6	2.87		6.5	4.48
3	6.7	4.31		5.3	2.55		6.5	4.23
4	5.9	3.83		5.2	2.67		6.2	3.1
5	5.6	3.3		5.7	2.97		6	3.44
6	6.5	3.1		5.8	2.85		6.4	5.7
Average		**3.84**			**2.84**			**4.135**

Diet 2 (whole algae)

Day 0 (fishes in the weight range of 1.5g – 2.5g considered)

Day 7

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	5.8	3.23		5.9	3.3		6.3	3.94
2	6	2.23		6	3.26		5.6	2.95
3	5.9	2		5.5	2.87		6.5	4.46
4	6.5	4.3		5.9	3.41		6.3	4.06
5	5.9	3.3		5.5	2.61		6.2	3.83
6	5.9	3.05		5.5	1.6		6.4	3.4
Average		**3.01**			**2.84**			**3.93**

Day 14

	Tank 1			Tank 2			Tank 3	
	Length (cm)	Weight (gm)		Length (cm)	Weight (gm)		Length (cm)	Weight (gm)
1	5.9	3.3		6	3.95		6.5	4.62
2	6.4	2.34		5.9	3.5		5.7	3.34
3	6.2	3.03		5.7	3.01		5.7	5.24
4	6.7	4.5		6	3.6		6.2	4.2
5	6.1	3.51		5.9	2.98		6.4	3.98
6	6	3.2		5.9	2.1		6.5	4.51
Average		**3.31**			**3.19**			**6.38**

1.4 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 supernatant was used for the analysis of Carbohydrates and Proteins.

Carbohydrate Analysis

i. 1ml supernatant 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 supernatant 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.

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.

Moisture content was calculated according to the formula A-B/A x 100 where A is wet weight and B is dry weight.

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 %

1.5 demonstration of Pelletizer

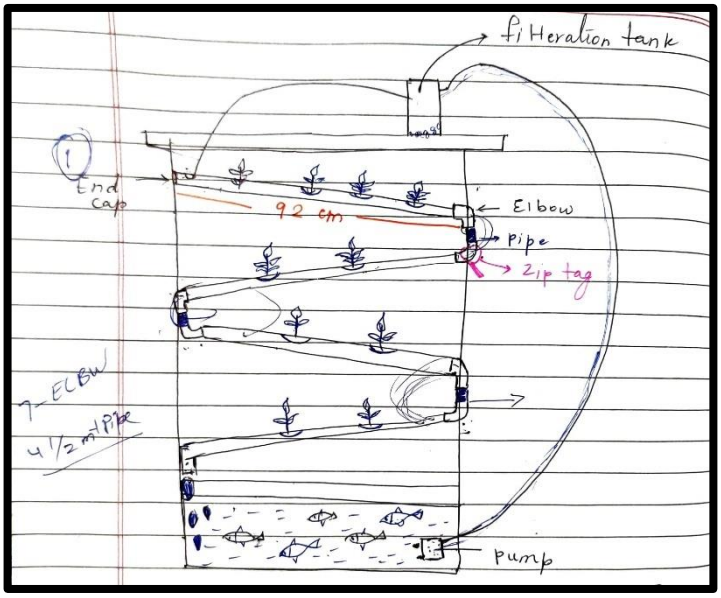
We were also demonstrated to use a Pelletizer machine which is used to make pellets of fish feed. For the demonstration the ingredients used were only wheat bran and water, a dough was prepared by using wheat bran and water and this was added in this pelletizer machine and pellets were obtained by passing the dough in the pelletizer, a rotating disc cuts the pellets into desirable size.

Pelletizer

2. AQUAPONICS SETUP

The aquaponic setup was done under the guidance of Dr Fraddry D Souza and Dr Elroy Pereira.

To build a small scale aquaponic system we read various reference article and as a group came up with an experimental setup, a diagrammatic representation was initially drawn and various ideas were discussed to come up with a setup



Diagrammatic representation of aquaponics setup used for reference

After approval from the guide and some suggestions the next thing prepared was a list of materials required at the materials, the said materials were purchase from the store.

Material required

The materials used for building aquaponics were

PVC pipes, zip tags, aquarium pump, end caps hydroponics cups, rubber tubes and M seal, solvent cement and silicone gel

additional requirements hole saw cutter set and drill machine

Procedure

1. The stand which was being used to build a setup was cleaned and placed near and electrical point

2. With the help of hole saw cutter and drill machine the required number of holes we trade on the PVC pipe according to the required size
3. Small holes would read on the end caps with the help of the hole saw cutter in order for the rubber tubes to pass
4. Using the zip tags the pipes with then fixed on the stand in a zigzag manner
5. These end caps what then a fixed on the PVC pipe using solvent cement
6. Rubber tubes were then passed through the holes and fixed with the help of M seal.
7. The last pipe was positioned in the tank for the clean water to come back in the tank
8. A biofilter was also placed in the tank which consists of ammonia converting bacteria
9. The ratio for placing plants: fishes in the aquaponic system was 2:1 according to a research article and thus in this aquaponic setup we placed five Tilapias and ten plants

Placing of plants in hydroponic cup

Aquaponic 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 OUTCOMES

In this one-month internship program

1. We learnt to formulate feed fish.
2. We attained Skill on maintenance of tank, fingerlings and measurement of weight and length of fishes.
3. We also gained an experience on setting up of small-scale aquaponics system.