Assessment on the Status of the prawn farm at Kwetu Training Centre

Assessment and Report compiled by

Stephen Mwangi, Enock Wakwabi, Charles Mitto, Charles Muthama, James Emuria and Patrick Mathendu

Kenya Marine and Fisheries Research Institute P.O. Box 81651, Mombasa

Kenya

Status of prawn pond at Kwetu Training Centre

"*Assessment and Report compiled by*

Stephen Mwangi, Enock Wakwabi, Charles Mitto, Charles Mnthama, James Emuria and Patrick Mathendu

Kenya Marine and Fisheries Research Institute P.O. Box 81651, Mombasa

Kenya

Background

A survey of the physical parameters in the prawn farm (pond) at Kwetu Training Centre was carried out on 16th May 2000 on request from the Centre. The small-scale farm was started in 1997. The farm is situated behind the mangrove swamp on the edge of Mtwapa Creek, about 003°57'8 039°43'N (GP8 reading). It was built by raising a dyke around a natural basin (salt pan) that is inundated on flood tides and dried out with ebbs. The farm is therefore directly filled and emptied with tidal gravity. It took 40 men about four months to construct the 0.8ha pond.

The pond has one sluice controlled gate through which water is allowed in and let out. This gate is also useful during harvesting. Water is changed once every fortnight (every spring) except the first month of stocking when the water change is once in a month to allow for the stocked fry to acclimatise with conditions in the pond. The pond is presently stocked with 24,000 post larval prawns since early March 2000, being the fourth

effective flushing. Chicken manure (droppings) is applied in the pond twice monthly (about 200kg every spring tide) to fertilize the pond. Lime is spread along the pond edges to reduce acidity in the pond.

The aim of the survey was to measure the physical and chemical parameters of the water and sediments in this pond and to advise Kwetu centre on the status and future treatment of the pond.

Sampling & Sample analysis

Three transects were established across the pond (figure 1). Along each transect, three sampling sites were taken in such a way as to have a fair representation of the pond. The sites were numbered *Nl, N2, N3,* Cl, C2, C3, SI, S2 and S3 (see fig. 1).

Water Temperature, pH, salinity and dissolved oxygen concentration were taken *in situ.* Water samples were collected to analyse for chlorophyll-a, total suspended matter, biological oxygen demand (BOD) and dissolved inorganic nutrients (i.e. ammonia, nitrates+nitrites and phosphates). Sediment cores were also taken for the analysis of the depth profiles of pH and temperature in sediments.

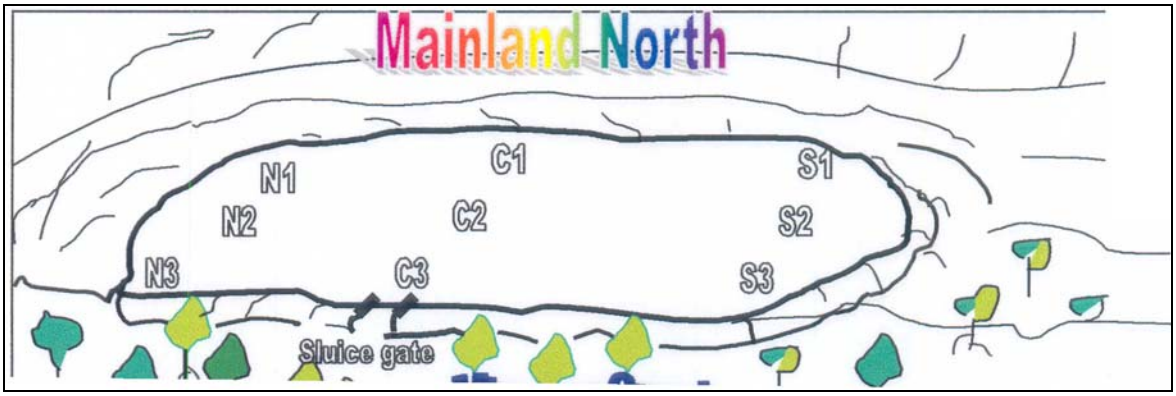

Figure 1. Rough sketch of Prawn pond at Kwetu Training Centre showing sampling sites

Results

Tables 1,2 and 3 show the results obtained from the sampling survey conducted on 16th May 2000 while table 4 compares the results from this study with those recorded by Kwetu personnel and those from the adjacent Mtwapa Creek from which the pond water is obtained.

Site	Water Temp (°C)	Sediment Temp (°C)	Water Salinity	Water pH	Mean sediment pH	Dissolved. Oxygen. (mg/l)	Dissolved Oxygen (% saturation)
N1	29.4	31.1	27.53	7.51	7.04	6.78	87
N2	29.1	29.25	27.11	7.44	7.02	5.80	78
N3	29.5	28.9	27.69	7.52	6.86	6.98	91
C1	28.9	28	27.52	7.41	6.8	5.35	73
C2	28.9	27	27.44	7.11	5.81	5.65	71
C3	28.8	27	27.44	7.51	6.67	5.35	72
S1	28.9	28	27.07	7.47	6.92	5.85	80
S2	28.7	28.7	27.63	7.49	6.91	5.36	74
S3	28.6	29.1	27.52	7.55	6.96	5.76	73.2

Table 1. Summary of hydrographic variables in the pond.

Site	Total coliforms (no/100ml)	Faecal coliforms (no/100ml)	*E. coli* (no/100ml)
N2	90	17	8
C2	50	17	2
S2	50	30	7

Table 2. Summary of microbial indicators of faecal contamination in pond water.

Site	Ammonia	Nitrates + Nitrites	Phosphates	Chlorophyll-a	SPM	BOD
	(µM)	(µM)	(µM)	(µg/l)	(mg/l)	(MgO_2/l)
N1	3.8	2.2	3.9	5.9	23.2	
N2	3.9	1.6	3.5	3.8	25.6	1.8
N3	3.8	1.2	3.6	8.7	21.3	
C1	4.2	1.6	2.9	9.3	25.6	
C2	4.1	1.7	2.7	5.9	24.2	
C3	4.1	3.3	2.3	6.7	24.2	1.3
S1	3.5	0.8	2.7	8.3	23.7	
S2	3.6	0.8	2.9	8.3	13	
S3	3	0.7	3.7	3.6	23.7	1.6

Table 3. Summary of dissolved inorganic nutrients, chlorophyll –a, suspended particulate material (SPM) and biological oxygen demand (BOD) levels in the prawn farm.

	Pond (This study)	Pond (1998 Kwetu report)	Mtwapa Creek Previous study
Ammonia (µM)	3.8	-	0.6
Nitrates + Nitrites (µM)	1.5	-	0.7
Phosphates (µM)	3.2	-	0.4
Chlorophyll-a (µg/l)	6.7	Green water	2.4
Suspended particulate material (mg/l)	22.7	-	26.9
BOD (MgO_2/l)	1.5	-	1.1
Water temperature(°C)	29	27.4 (range 23-29)	28.4
Sediment temperature(°C)	28.6		-
Water pH	7.4	6.0 (range 5-7.5)	8.04
Sediment pH	6.8		-
Water salinity(psu)	27.4	37.4 psu (range of 26-45psu,	32.6
Dissolved. Oxygen (mg/l)	5.9	-	5.8
Total coliforms (no/100ml)	63	-	584
Faecal coliforms (no/100ml)	21	-	389
E. coli (no/100ml)	6	-	254

Table 4 Summary of average levels of environmental and biological variables in the prawn pond and Mtwapa Creek.

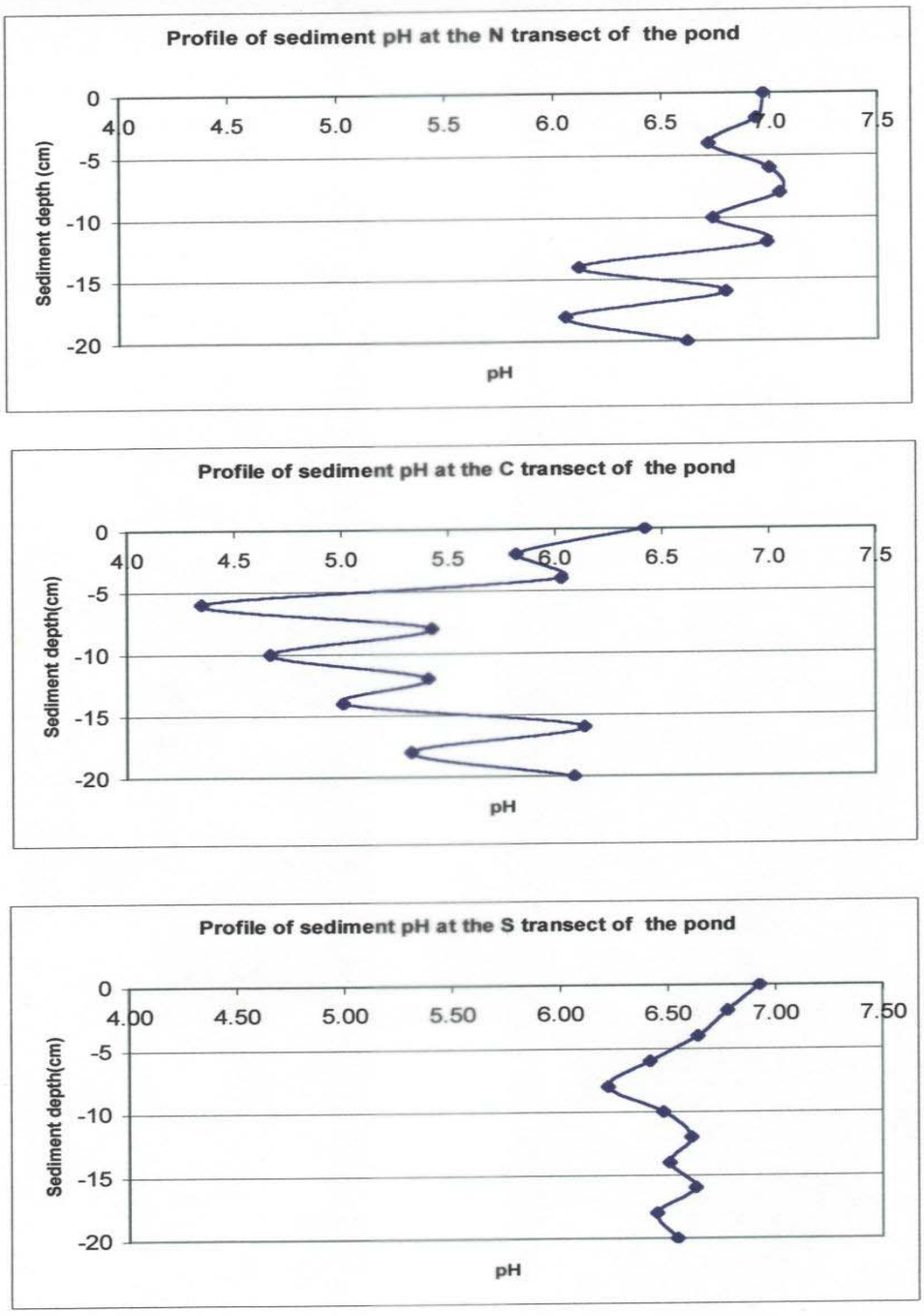

Figure 2. Mean sediment depth pH profile in the prawn pond

(NB: pH of overlying water was pH 7, pH 6.4 and pH 6.9 for N, C and S sections of the pond respectively).

Observations:

This is a shallow pond (about 1M deep). Therefore no water column depth sampling was carried out.

Pond water pH was generally uniform about neutrality (7.4). This was slightly higher than the levels recorded in the pond between July to October 1998 but lower than pH 8.0 recorded in Mtwapa Creek. It is recorded from elsewhere, that for this kind of culture, water pH between 7.5 and 9.0 is favourable.

Sediment pH was always below neutrality (7.0) with increasing acidity with depth and towards the centre of the pond (Fig. 2). The slightly higher pH observed towards the surface in sediments was probably the effects of liming applied on the edges of the pond.

Dissolved oxygen concentration was reasonably high though it is observed that this did not reach saturation levels. The observed levels of oxygen concentration in the pond (greater than 4 mg/l) are however favourable for prawns culture.

The low biological oxygen demand (BOD) that was observed in the pond was comparable to the mean BOD recorded in Mtwapa Creek. This implies that the organic loading in both the creek and the pond was below anoxic levels. It was however noted that there were signs of anoxic conditions in the lower layers of sediments especially along the edges of the pond.

Nutrient concentration in the pond was higher than in the adjacent creek. This was principally the result of fertilization applied in the pond. The higher levels of chlorophyll a in the pond water further complemented this increased fertility. Kwetu personnel also recorded high fertility in the pond between July and October 1998 as increased 'greenness' of the water.

Pond water temperature was comparable to the average recorded in the creek. Records from Kwetu show that the water temperature was higher recorded during the dry months

of the year. Salinity was even more variable (26-45 psu), the highest having been, recorded in October and the lowest in July. Being a small water mass, this pond is significantly affected by evaporation and precipitation.

It is important to note that prawns can withstand variability in salinity, temperature, and dissolved oxygen levels in water. Sediment pH can have deleterious effects but this easily checked by lime application. For example, it is known that prawns can be raised in salinity of between 15 and 30 psu (Kwetu info).

Microbiological quality of the water in the pond is influenced by Mtwapa Creek as is indicated by the presence of faecal coliforms and *E. coli.* However, from this assessment, the level of contamination was not high and pond water is fit for prawn farming.

Conclusion

In general, Kwetu centre is doing a good job. Being a pioneer for this kind of culture system and also considering the initiative to marry this exercise with effective environmental management, the success of this farm can be a starting point to expand the practice to the rest of the Kenyan coastal area with the same kind of features. The system is small enough for transfer of technology, cost effective and environment friendly. We advice that the lime application should cover the entire pond area and not just the edges. To achieve this, lime can be applied at lowest spring tide before filling and stocking the pond. Thereafter, a boat may be used and the lime broadcast in the pond. This will control the pH over the entire pond surface.

General recommendations

1. A monitoring program involving both Kwetu Centre and KMFRI to be established. This monitoring should involve in addition analysis of production (stocking densities) and other population parameters useful for the management of the farm. This way, changes in water and sediment characteristics from one spring tide to the other can be

established and decision on the frequency of change of pond water taken. Also, the availability of seed for stocking will be checked to maximise the pond facility.

2. Fertilization of the pond using chicken manure seem to be yielding good results. Occasional application of commercial fertilizer e.g. ammonium phosphate may be tried if funds allow.

Acknowledgement

The contribution of Kwetu personnel and especially the marine farming section is highly acknowledged.