GROWING SOFT CLAMS (Mya arenaria) COMMERCIALLY in the COMMONWEALTH OF VIRGINIA

by

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Project overview - Comparison of two potential grow out methods for soft clams.

Growing Soft Clams (Mya arenaria) Commercially in the Commonwealth of Virginia was proposed by John Vigliotta with the objective to raise soft clams from 2 mm to market size in less than two years. Two different grow out methods were investigated. The first method was land based, reusing water from our existing shellfish nursery system. The second method consisted of trays deployed into open water on our leased grounds in the Ware River of Virginia.

Our first method of soft clam seed grow out was happened upon during the 1998-1999 season when Middle Peninsula Aquaculture used a portion of Ward Oyster Company's nursery system. We noticed that the soft clam seed that had been accidently washed into the drainage trough not only survived there but thrived during the summer of 1999. It was this observation that fueled the desire to explore this option as a soft clam grow out system. With the help of this grant we expanded our then existing trough to 60 feet in length and 11 feet in width enabling us to provide sufficient room for our new soft clam seed. (diagram 1) In addition we increased the water flow to provide adequate flow to the soft clams. This portion of the project increased the potential profit from an already existing aquaculture system.

For our second method we designed and had constructed fiberglass trays 3' by 3' and 5" tall. (diagram 2) Initially only a plastic lid was intended for the cover but we quickly observed a predator problem on the first trays put overboard. The large holes in the plastic lids enabled blue crabs to enter the trays and feast on the seed. Luckily we saw this problem early in the program and were able to include a quarter inch by quarter inch mesh netting under the lids. This additional netting seemed to eliminate some of this problem.

We obtained 400,000 2 mm soft clam seed from Middle Peninsula Aquaculture on December 10, 1999. This seed had been spawned in October of 1999. The seed was placed in our upweller tank system for grow out to a planting size of 10 to 15 mm. The seed was kept in our upweller system until June of 2000. The seed did well over the winter however did not grow as fast as expected during the early spring. Please see the activity log for more exact information and time line events.

A 10 ft. by 45 ft. area of the new trough was filled with sand. Fifty four fiberglass trays were also filled with sand. This gave us roughly the same square footage in the two methods. The trays were seeded with 5 liters each of soft clam seed. In order to ensure that the seed acclimated to the sand in a quick manner we filled the trays with sand and placed them in the empty trough to fill with water then sowed the seed in the trays. We were very pleased with the speed that the seed buried themselves in the sand. We then transferred the trays to our barge for placement. The trays are very labor intensive and cumbersome to move. After all of the trays were completed the remaining seed was scattered in the new trough at the same density as the trays Once again the seed quickly acclimated to it's new sand bed.

Included are photos taken of the extended trough and the seed right after being planted in the trough. Photo #1 shows the new drainage trough, the soft clam seed area is from the top of the trough to the line of cement blocks used to contain the sand media. To the left of the trough the upweller tanks that the seed was initially kept in can be seen. Our existing raceway system is to the right. The out falls of both systems fuel the water flow to the seed. Photo #2 is a close up of the seed the day it was planted in the trough. The seed started burying itself immediately and within two hours all the seed was covered. In the right hand corner of this photo the empty trays can be seen.

During the time period from August 2000 to August 2001 we monitored both the trough system and the tray system monthly for growth and predators. Several observations about the two different grow out systems were made during the course of this project. As far as accessibility the on land system had a large advantage. It was easily monitored for predators and due to this we feel that very little seed was lost to crabs in the trough. In addition, it only takes one person to handle the monthly growth monitoring and subsequently would be easier to harvest from. A major drawback of the trough system was seen during the summer months during the soft clams second year of growth. Total mortality was experienced in the late summer of 2001. During the summer of 2001 water temperature in the Ware River was up to 87 degrees Fahrenheit. As you can see by the photos the water flow in the trough comes from the upweller tanks and raceways lining each side of the trough. We regularly rinse out these tanks and raceways to clean out the shellfish feces and river sediment that collects in them. We have spoken with Mike Oesterling of the Virginia Institute of Marine Science and he confirmed that the decomposition of the shellfish waste in addition to the high temperature levels could cause low oxygen levels. In addition, the elevated water temperature could have further stressed the soft clam seed contributing to the mortality. We did not see any die off in 2000 for a couple of reasons. The water temperature in 2000 was averaging 80 degrees in August and the clam seed had just been planted in the trough using clean sand with no build up of matter to decompose. Our recommendation is circulation modification and additional aeration.

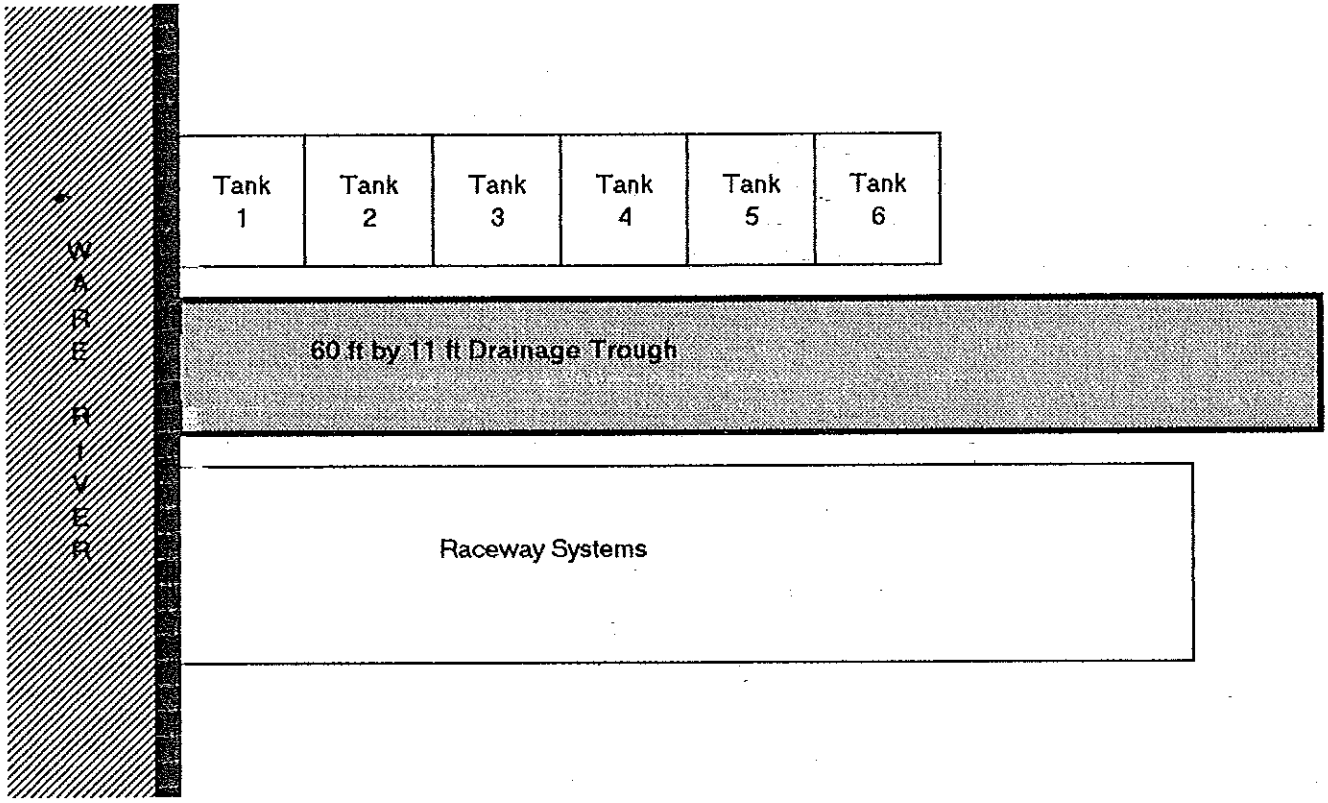
The tray system has a disadvantage in that they are very difficult to access and handle. The trays weigh approximately 250 lbs each. In order to pick them up it takes 3 to 4 people and we had to create a stand to hold the tray to clean out the clams. Predators are the major problem in the trays. We had to take measures to keep them out of the trays. We had much better success with a mesh cover and the plastic lid. One improvement that would need to be made to the tray system is a better recovery method. We had only two rope handles on each tray. Our recommendation is a modification to the tray to enable the use of a barge equipped with chain falls to pull up the trays.

We have seen that soft clams grow in the systems we used, however not at the rate we had hoped for in order to market them for sale within two years. Neither systems seemed to hold an advantage over the other in growth rate. Our biggest soft clams average 36 mm - approximately one and a half inches. (see measurement diagrams) Wild soft clams currently sold on the market average well over 2 inches. We were able to get samples out to several different sellers of soft clams in order to judge the acceptance of these smaller clams with the consumer. The reaction from all the users was that the clams were just too small for marketing. We plan to keep the remainder of the seed in the tray system for further grow out through the winter and try once again to market them next summer.

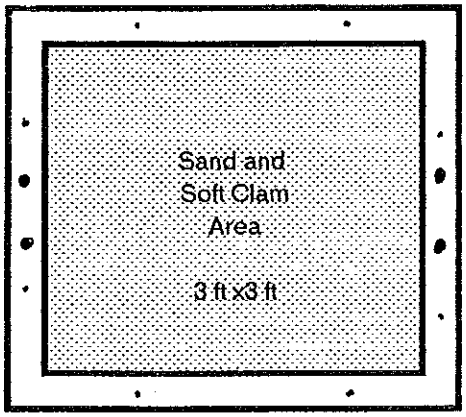
Conclusion - Both systems did achieve soft shell clam (Mya arenaria) growth. An increased trough size for anyone with an on land aquaculture system is recommended. Through our experiences with our trough we have found that it can be utilized for use in temporary grow out of several different species and also as a temporary wet storage facility for aquaculture. We feel that the trough system is an easier and more convenient method for companies already using an on land system.

The tray systems are limited in use to companies or individuals with the access to underwater leases and the man power and equipment needed for deployment and recovery. With some handling modifications this system is workable. One note - we don't believe it is possible to create a lighter model of these trays. Due to the weight they are required to hold, it is necessary for them to be made out of a strong material. In addition, sand is not only needed for protection of the soft clams but to weigh the trays down from floating.

While we have found that we are indeed able to spawn and grow soft shell clams it was not profitable for our project. The impact of the modifications mentioned earlier on the success of grow out and survival is still in question. One thought for possible improvement on this project is a spring spawning or an earlier fall spawning in an effort to get the soft clams to market size before the end of the second year. However, Kenneth Kurkowski, an advisor to this project, did not feel that a spring spawning would be beneficial due to the lack of growth generally seen in the summer months. We will keep the aquaculture industry updated, if interest is shown, on whether or not the remaining seed reaches a marketable size before succumbing to disease or predators.


WARE RIVER
Tank 1
Tank 2
Tank 3
Tank 4
Tank 5
Tank 6
60 ft by 11 ft Drainage Trough
Raceway Systems

Top View



Side View

Each tray has two holes along each edge for tying down lid and screening with plastic ties. 8 total
In addition there are 2 larger holes on two opposite sides of the tray for rope.

Photo # 1 - Extended Trough

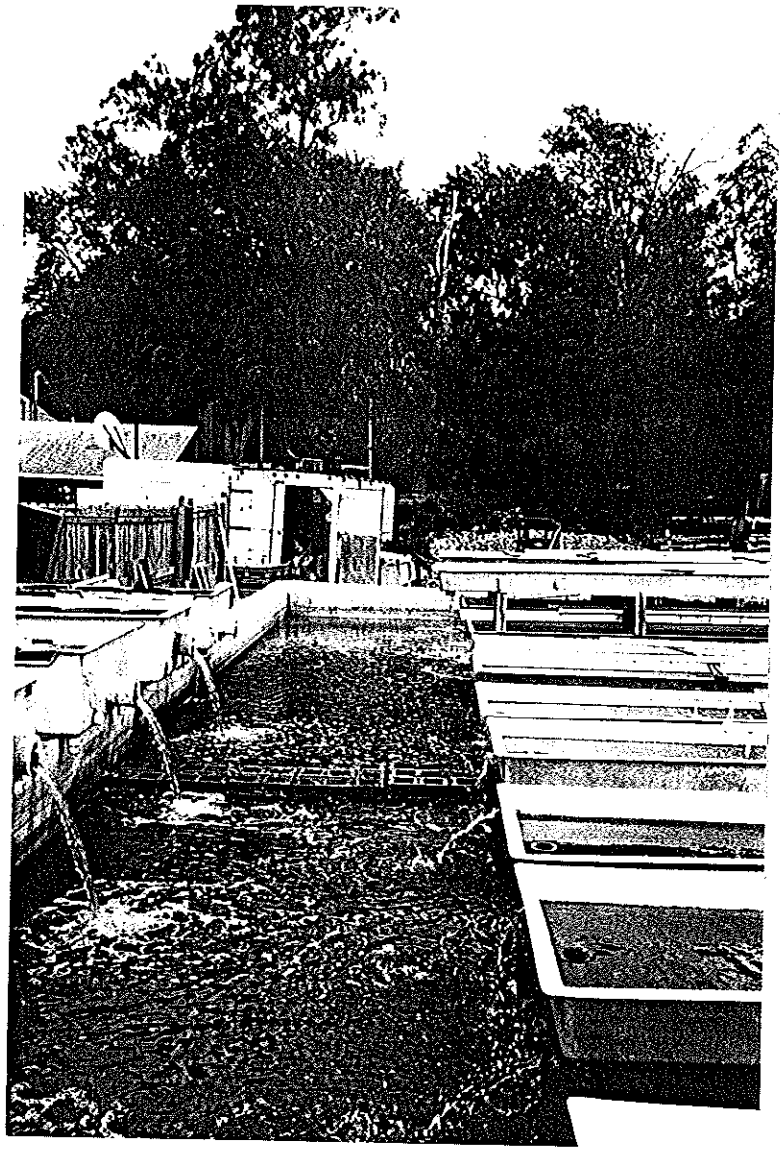
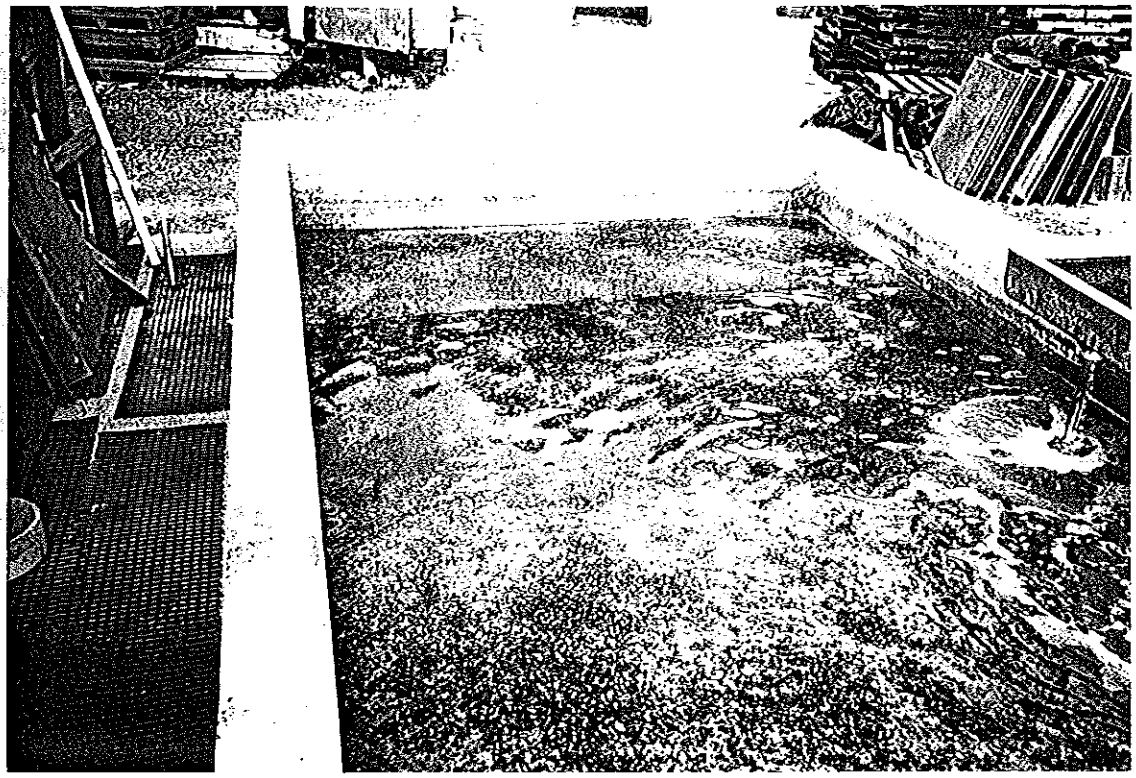


Photo # 2 - Soft Shell Seed - Day of Planting



Activity Log

12-10-99	Purchased 400,000 2 mm soft clam seed from Middle Peninsula Aquaculture. Placed in three 12 inch upwellers in one tank.
12-27-99	Graded and dispersed the seed into five 18 inch upwellers and one 12 inch upweller.
1-13-00	Thinned out seed to eight 18 inch upwellers and one 12 inch upweller.
4-11-00	Soft clams split between nineteen 18 inch upwellers in two tanks. Tanks are rinsed out weekly at this point.
5-8-00	Tanks washed out every four days.
5-12-00	Divided soft clams into thirty 18 inch upwellers.
6-15-00	Put over 14 trays - 5 liters each.
6-17-00	Checked trays - crabs seen under the lids and eating seed.
6-26-00	Took up the first 14 trays - no live soft crabs. Took out 4 inch live crabs and shedded crab shells. Put over 9 trays, 5 liters each. Instead of just a plastic lid some trays were outfitted with a quarter by quarter netting and others with an eighth of an inch netting under the plastic lids. The use of just the plastic lids let in too many crabs.
6-27-00	Put over 11 trays, 5 liters each.
7-5-00	Put over 10 trays, 5 liters each
7-11-00	Put over 10 trays, 5 liters each
7-14-00	Put over remaining seed in the trough measuring 10 ft. by 45 ft.
8-14-00	Checked seed in trough - little if any loss to predators or death at this time. Measured a random 50 seed - size range from 8 to 25 mm. Avg. 17.34 mm Checked seed in trays - Net seems to be holding out most crabs. No death seen at this time. Size range from 5 to 27 mm. Avg. 16.16 mm

9-15-00	Checked seed in trough - The trough is checked daily for crabs due to it's easy access and very few are seen. Soft clams seem to be in good shape with growth rings evident. Random samples show seed ranges from 10 to 39 mm with an average of 21 mm. Checked seed in trays - Some small crabs are evident. Will have to continue to monitor to see if it becomes a problem. Some fouling of the lid and netting. Size range from 10 to 32 mm with an average of 19.66 mm.
10-10-00	Trough- size range 11 to 32 mm - Average 20 mm Trays - size range 10 to 35 mm - Average 21.2 mm
11-12-00	Trough - Size range 15 to 35 mm - Average 24.5 mm Trays - Size range 10 to 35 mm - Average 21.96 mm
12-14-00	Due to cold temperatures we did not pull clams for sampling this month. Concerned about freezing.
1-9-01	Trough - Size range 15 to 38 mm - Average 23.8 mm No predators seen. Growth is evident but less then what we expected. Survival looks good. Trays - Size range 15 to 38 mm - Average 24.42 mm While no blue crabs are evident, angelwings and rock crabs are in the sand in the trays. Took two trays and removed the seed from the sand. A volume measurement showed a growth in volume of 2.5 times. We started with 5 liters per trays and had 13 liters per tray when measured.
2-6 -01	Trough - size range from 15 to 38 mm - Average 24.88 mm Trays - size range from 18 to 40 mm - Average 29.06 mm
3-13-01	Trough - size range from 17 to 40 mm - Average 28 mm Trays - size range from 20 to 42 mm - Average 32.9 mm
4-12-01	Trough - size range from 21 to 46 mm - Average 32.08 mm Trays - size range from 20 to 42 mm - Average 33.4 mm
5-4-01	Trough - size range from 30 to 46 mm - Average 36.7 mm Trays - size range from 20 to 40 mm - Average 30 mm
6-7-01	Trough - size range from 31 to 48 mm - Average 36.4 mm Trays - size range from 22 to 48 mm - Average 35 mm Tray had quarter by quarter mesh only - Large blue crab was inside tray and had eaten a lot of the seed.

7-10-01 Trough - size range from 30 to 46 mm - Average 36.1 mm
Starting to experience some death in the trough. We believe due to the hot water temperature and possible disease.
Trays - size range from 22 to 48 mm - Average 36.46 mm
This tray had an eighth of an inch mesh under the plastic cover, no crabs were seen and a much larger volume was taken from the tray.

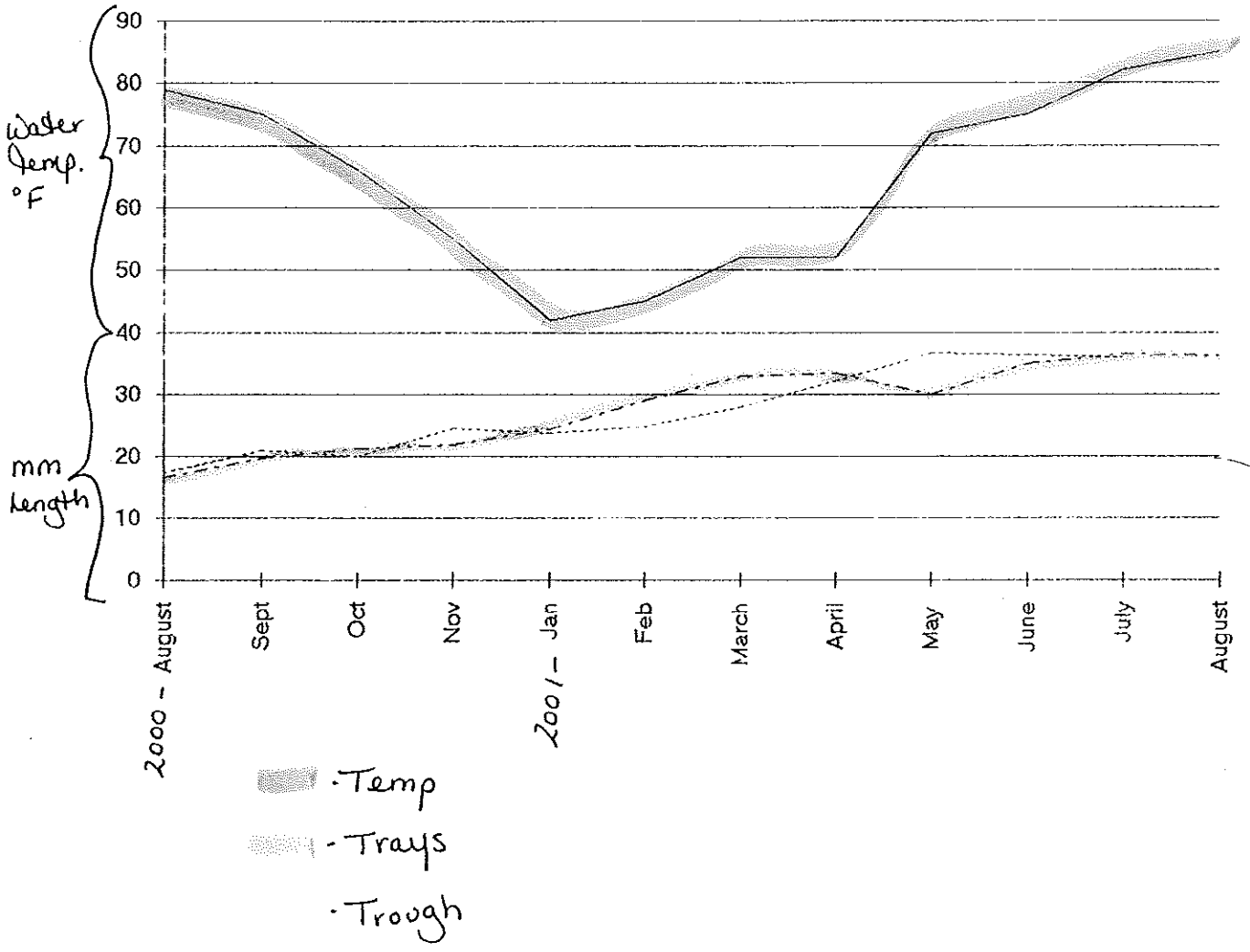
8-29-01 Trough - Experienced a total die off - Shells range from 18 to 42 mm.
Trays - Took up 4 trays. Size range from 18 to 45 mm - Average 36.22
2 trays had mesh and plastic lids. Got a total of 65.9 lbs. Much better survival. The other 2 trays only had a mesh cover. Only got a total of 28.7 lbs back. Crabs had taken a large toll on the seed.

Soft Clam Seed Measurements - Trough

August 2000	Sept 2000	Oct 2000	Nov 2000	Jan 2001	Feb 2001	March 2001	April 2001	May 2001	June 2001	July 2001	August 2001
8	27	13	20	15	17	19	28	32	48	31	
12	26	11	20	15	20	25	29	40	36	39	
15	30	14	18	18	20	25	36	40	36	42	
10	18	18	30	16	25	35	32	42	46	46	
20	25	12	32	20	30	32	32	37	37	40	
22	18	20	34	18	31	30	46	30	34	25	
21	10	22	35	17	26	32	42	36	46	30	
20	18	18	32	21	27	31	28	36	30	46	
15	18	32	27	25	30	35	28	32	45	45	
18	12	30	29	20	17	18	29	42	40	29	
10	30	19	27	15	18	22	36	46	33	34	
12	16	26	28	16	20	23	34	45	36	36	
18	18	28	18	20	22	25	38	45	34	42	
13	17	29	18	23	28	31	32	39	32	42	
20	20	30	17	25	29	30	37	39	40	38	
25	17	31	19	28	30	33	30	45	34	34	
24	21	13	17	30	32	19	29	37	32	32	
9	28	12	17	31	39	21	38	32	35	37	
21	18	14	16	29	40	20	26	34	38	32	
16	17	16	15	27	18	22	26	33	34	34	
17	15	14	18	25	21	27	29	39	32	34	
20	18	18	20	30	29	39	26	40	36	39	
10	20	21	25	30	22	40	40	40	34	40	
12	29	28	22	32	23	18	46	47	36	41	
20	15	26	27	38	25	40	29	36	36	43	
25	14	27	29	33	21	32	28	32	37	42	
25	15	30	30	29	29	36	28	31	37	43	
15	18	12	34	37	30	36	30	30	35	31	
17	10	17	35	38	18	26	32	28	33	33	
19	11	20	35	34	24	27	39	42	34	36	
20	23	27	33	30	25	28	36	44	33	40	
24	27	29	31	31	26	29	28	34	32	42	
22	14	30	29	22	21	31	27	36	41	31	
11	20	30	30	23	22	33	26	31	36	31	
11	26	19	27	24	29	23	29	34	41	34	
16	22	13	28	22	30	24	33	39	36	32	
17	29	13	26	19	22	25	27	37	36	32	
20	26	12	28	15	21	26	29	32	35	37	
25	24	11	29	19	25	26	32	32	35	38	
23	28	17	35	20	26	30	36	41	31	39	
18	27	19	15	21	27	31	36	34	37	39	
15	30	22	15	29	29	29	37	38	39	43	
19	16	30	17	22	31	20	29	38	34	33	
22	14	12	15	25	18	28	21	31	40	36	
23	15	12	19	18	20	25	28	31	38	40	
11	20	15	20	18	22	26	29	33	38	34	
13	22	11	22	17	21	26	24	29	37	34	
16	26	18	23	20	20	29	38	32	36	34	
20	39	18	23	21	22	30	39	43	35	38	
12	30	19	18	19	26	32	37	39	34	38	
AVG											
17.34	21	20	24.5	23.8	24.88	28	32.08	36.7	36.4	36.1	

Soft Clam Seed Measurements - Trays

August 2000	Sept 2000	Oct. 2000	Nov. 2000	Jan. 2001	Feb. 2001	March 2001	April 2001	May 2001	June 2001	July 2001	August 2001
10	20	10	35	15	19	42	40	34	34	31	36
8	32	12	34	15	18	40	39	32	36	42	36
22	31	10	35	18	25	39	32	33	34	37	31
26	30	20	32	36	24	42	29	30	41	33	30
11	19	15	30	38	30	25	31	33	35	32	39
21	19	18	29	35	18	20	28	24	35	40	40
12	21	26	30	35	40	26	30	31	34	32	43
25	18	24	26	29	19	32	32	26	30	37	38
16	15	22	27	27	26	35	34	32	35	25	38
18	16	30	29	21	24	39	36	32	46	32	32
13	10	35	24	20	23	40	33	33	38	35	43
12	12	31	26	26	22	40	32	28	25	37	36
8	11	29	21	29	20	38	39	27	36	38	35
10	17	28	20	30	32	36	35	32	34	45	40
5	17	15	21	31	33	20	40	30	39	38	37
19	20	17	21	15	34	22	42	32	40	27	38
21	19	15	15	15	36	24	40	27	34	41	41
25	26	15	15	17	40	23	40	20	23	43	42
27	22	26	16	19	29	32	39	32	22	32	28
11	24	24	18	20	29	34	40	28	40	37	35
15	29	27	15	26	20	39	39	30	40	34	18
17	28	30	10	22	23	31	42	33	34	32	34
16	26	15	11	17	38	32	38	20	39	32	32
10	24	10	15	27	37	36	31	37	42	32	36
9	22	24	16	25	36	35	32	31	37	38	35
12	19	29	16	26	40	39	25	33	33	48	29
25	18	30	24	16	34	38	36	22	31	42	40
13	15	10	26	18	32	40	32	32	40	40	32
14	10	11	26	30	31	32	32	30	30	34	42
10	12	15	15	30	29	34	29	30	37	36	45
13	11	14	18	38	36	30	22	23	25	34	36
13	10	19	20	29	36	32	20	32	32	41	40
20	20	18	21	30	34	33	36	30	33	35	42
21	19	22	23	19	36	38	34	31	32	35	40
19	18	24	26	20	25	39	28	31	37	34	40
18	30	26	28	21	40	26	26	29	38	34	38
18	10	29	30	20	34	29	22	27	42	35	40
20	15	30	35	23	30	30	35	28	38	46	39
20	14	35	15	24	29	31	38	32	25	38	38
10	12	32	17	24	27	33	30	32	41	25	37
13	19	14	12	25	23	29	33	32	43	36	35
12	25	14	12	25	24	27	25	33	30	34	37
18	24	19	15	16	33	30	40	34	37	39	36
20	26	19	19	20	35	30	40	40	34	42	29
19	28	21	18	29	38	37	30	32	32	34	36
19	19	23	18	28	29	31	32	30	32	23	34
22	18	26	21	29	29	28	24	35	38	22	36
24	20	25	24	28	18	32	39	28	48	43	31
18	22	11	25	22	18	36	39	32	42	42	30
10	21	16	23	23	18	39	30	22	40	34	36
AVG											
16.16	19.66	21.2	21.96	24.42	29.06	32.9	33.4	30	35	36.46	36.22


Water Temp. °F
mm length
90
80
70
60
50
40
30
20
10
0
2000 - August
Sept
Oct
Nov
2001 - Jan
Feb
March
April
May
June
July
August
- Temp
- Trays
- Trough