

Use of Microalgae Concentrates for Rearing Oyster Larvae, *Crassostrea virginica*

F. Scott Rikard¹ and William C. Walton^{1,2}

¹Auburn University Shellfish Laboratory, Department of Fisheries and Allied Aquaculture, Auburn University,
²Alabama Cooperative Extension System



Oyster larva grown with microalgae concentrate

Introduction

Shellfish hatcheries typically use large quantities of single-cell phytoplankton (microalgae) to feed shellfish larvae. Algae production requires hatcheries to commit large square footage and equipment cost to culturing phytoplankton. Additionally, culturing algae requires committing significant labor and other operating costs to maintain algal cultures and equipment. The development of microalgae concentrates for feeding shellfish larvae provides the opportunity to mitigate significant capital and operational costs.

The Auburn University Shellfish Laboratory (AUSL) has been using microalgae concentrates for rearing oyster larvae, *Crassostrea virginica*, for 10 years and is currently working to develop best management practices for use in shellfish hatcheries. AUSL uses Reed Mariculture Inc.'s Shellfish Diet 1800[®] which is a mix of four marine microalgae: *Isochrysis sp.*, *Pavlov sp.*, *Thalassiosira weissflogii* and *Tetraselmis sp.* The product has an 18-24 week shelf life when refrigerated at 2-4 °C. Technical data are given in Table 1.

Feeding Protocols

AUSL has tested three microalgae feeding protocols consisting of batch feeding twice/day (existing AUSL protocol), continuous feeding and continuous feeding plus ClorAm-X[®] additive for ammonia control. Feeding protocols were tested on low larval density (Table 2) static culture tanks with water change and tank cleaning every two days. To date, the three feeding protocols produce similar growth results (Fig. 1) although continuous feeding with the ClorAm-X additive showed a trend for increasing the harvest of larvae competent to settle (Fig. 2).

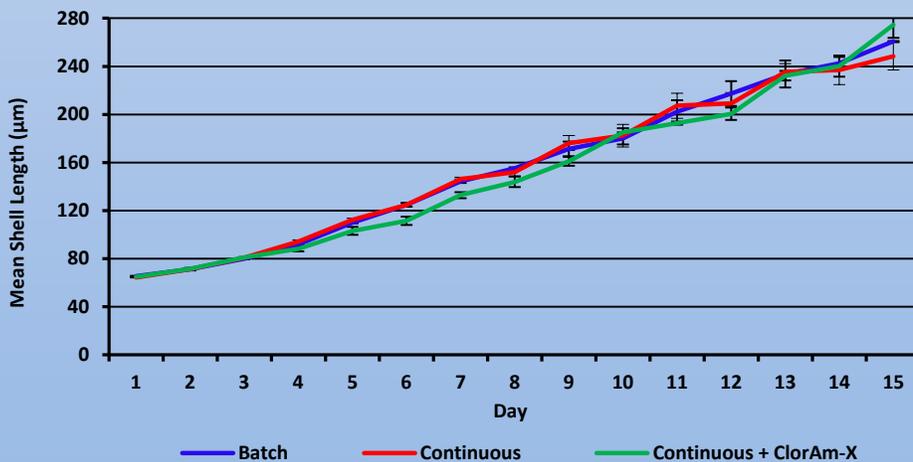


Figure 1. Mean shell length (µm) of oyster larvae reared with a microalgae concentrate using three feeding protocols: batch feeding twice/day (existing AUSL protocol), continuous feeding, and continuous feeding plus ClorAm-X[®] additive for ammonia control.

Table 1. Technical Data

Description	Shellfish Diet 1800 [®]
Appearance	Brown-Green Viscous Liquid
Algal size	4 - 20µm
Microalgal Biomass	>8%
Composition of Biomass (dry wt.)	
Protein	52.0%
Lipid	16.1%
Carbohydrate	22.0%
Ash	9.9%
Microbial Specification¹	
Coliform bacteria ²	<0.3 MPN/mL
Salmonella ³	Negative
Known pathogenic marine bacteria	Negative

1. Tested quarterly; 2. Fecal/mL; 3. Bax/100g
Technical data provided by Reed Mariculture Inc.

Table 2. Larval Feed Rate

Day	Stocking Density (larvae/ml)	Shellfish Diet 1800 [®] (ml/day/million larvae)
0	10	0.5
1	10	1.0
2	5	2.5
3	5	3.0
4	5	4.4
5	5	5.0
6	4	5.6
7	4	6.3
8	4	9.2
9	4	10.0
10	3	11.7
11	3	13.3
12	3	15.0
13	3	16.7
14	3	20.0

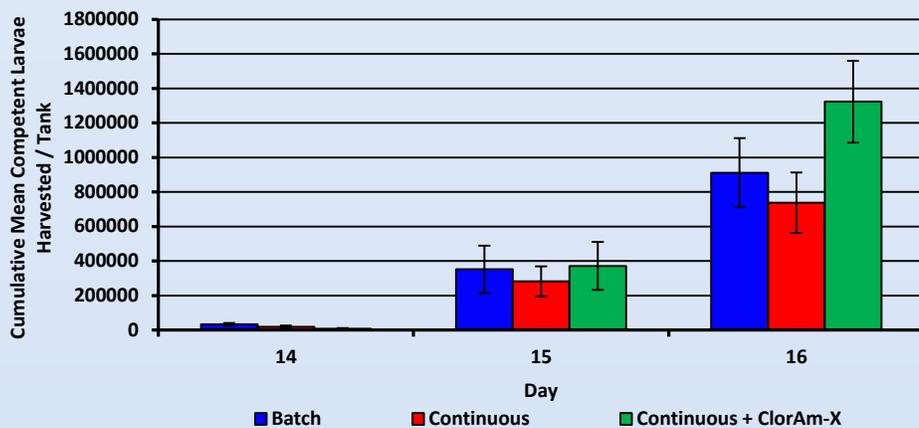


Figure 2. Mean cumulative harvest/tank of oyster larvae competent to settle reared with a microalgae concentrate using three feeding protocols: batch feeding twice/day (existing AUSL protocol), continuous feeding and continuous feeding plus ClorAm-X additive for ammonia control.

Recommended Techniques

For batch feeding, mix Shellfish Diet 1800 with 500 ml of NaCl solution (30 %) to disperse algal cells and prevent clumping. Then pour the algae suspension into the larval rearing tank through a 20 µm screen to further disperse the algal cells and remove any larger cells that cannot be consumed by the oyster larvae (Fig. 3). The amount of microalgae to be fed each day during the larval cycle is given in Table 2. Divide the amount to be fed per day by the number of feedings per day. Two feedings per day appears to be adequate for consistent larval growth but more frequent feedings will likely add to feeding efficiency.

For continuous feeding protocols, a peristaltic pump controlled by a cycle timer (Fig. 4) delivers a microalgae concentrate suspension (stored in a refrigerator) to larval rearing tanks. For the two continuous feeding protocols, Shellfish Diet 1800 or Shellfish Diet 1800 plus ClorAm-X for one 24 h feeding period is diluted in 3.5 L (for each tank to be fed) of NaCl solution (30 %) and then poured through a 20 µm screen into a bucket and placed in a refrigerator (Fig. 5). A circulator pump is added to the microalgae suspension to prevent settling of the algae (Fig. 5). ClorAm-X can be added to the bucket, if desired, at a rate of 0.12 g ClorAm-X per ml of Shellfish Diet 1800. The cycle timer and peristaltic pump is set to deliver the microalgal suspension to the larval culture tanks at a rate of approximately 12 ml/min for 2 minutes, 6 times per hour.

Feeding Rate and Cost

The recommended daily amount of Shellfish Diet fed during a larval cycle is given in Table 2. Based on these recommendations, the cost per million larvae is \$6.88 assuming a 14-day grow-out at current per unit prices (volume discounts available through Reed Mariculture Inc.).

Shellfish Diet 1800 is a registered trademark of:
 Reed Mariculture Inc.
 900 E. Hamilton Ave., Suite 100
 Campbell, CA 95008 USA
 Phone: 1-877-732-3276 or 408-377-1065
 www.reed-mariculture.com

ClorAm-X is a registered trademark of:
 AquaScience Research Group, Inc.
 1100 Gentry St.
 North Kansas City, MO 64116 USA
 Phone 816-842-5936
 www.aquascienceresearch.com



Figure 3. Batch feeding microalgae concentrate by pouring through a 20 µm screen into larval tanks.



Figure 4. Peristaltic pump controlled by a cycle timer for continuous feeding microalgae to larval tanks.



Figure 5. Microalgae solution placed in a refrigerator for continuous feeding to larval tanks via a peristaltic pump. Small circulator pump used to keep microalgae in suspension.

For more information, contact
 Scott Rikard or Bill Walton at:
rikarfs@auburn.edu or billwalton@auburn.edu
 Phone: 251-861-3018

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 Mississippi-Alabama



F. Scott Rikard and Bill Walton
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