

LOAN COPY ONLY

TAMU-H-91-001 C3

Practical Manual for Semi-intensive Commercial Production of Marine Shrimp



Aquaculture

Jose R. Villalon

with support from
Granvil D. Treece

Texas A&M University Sea Grant College Program

LOAN COPY ONLY

Practical Manual for Semi-intensive Commercial Production of Marine Shrimp

Jose R. Villalon

CIRCULATING COPY
Sea Grant Depository

TAMU-SG-91-501
April 1991

\$15.00
Additional copies available from:
Texas Sea Grant Program
P.O. Box 1675
Galveston, Texas 77553-1675
U.S.A.

TAMU-SG-91-501
2M April 1991
NA89AA-D-SG139
A/F-4

Foreword

The world's population has moved into an age where it must rely increasingly on farm-raised products and less on wild populations for food. People are moving away from being hunters and gatherers and more toward being farmers and culturists. Shrimp farming, the production of marine shrimp in impoundments or ponds, has developed rapidly in recent years. More than 40 countries around the world now raise shrimp in ponds. For the tenth year in a row, the world's shrimp farmers produced a record crop in 1990, a total of 633,000 metric tons of whole shrimp, up 12 percent from the previous year. One million hectares of ponds yielded an average of more than 630 kilograms per hectare. Shrimp farmers now produce 25 percent of the shrimp placed on world markets and fishermen supply 75 percent of a total market of 2.6 million metric tons. Shrimp farmers produced only 2 percent of the world's needs in 1980. If production continues to expand at the current rate, farm-raised shrimp will capture 50 percent of the total market by the year 2000.

To a large extent, development is driven by market demand. Shrimp farming, however, is constrained in many countries and inefficient use of existing resources is widespread in many of the countries now culturing shrimp.

This book represents a significant step toward defining the basic principles and most important steps in the pond culture of marine shrimp. Variations of these techniques and principles described may be used at different locations with different species for both semi-intensive and, to some extent, intensive culture systems.

There is a great deal of printed matter concerning shrimp mariculture, but there is very little written material from a commercial standpoint. This manual describes the methods used by a private company on a commercial scale to raise penaeid shrimp successfully in earthen ponds from the fry or postlarval stages to market size.

The Texas A&M University Sea Grant College Program welcomes the opportunity to publish this manual and hopes to extend the distribution of this information to the global aquaculture community. Hopefully, it will be useful to shrimp farmers and researchers worldwide. Perhaps this manual will stimulate others to share more from a commercial standpoint in the development of culture systems that will result in more efficient use of our earth's resources.

Granvil D. Treece
Aquaculture Specialist
Sea Grant College Program

Acknowledgments

I wish to thank Dr. Samuel P. Meyers for initially suggesting publication of my working manual. I would also like to acknowledge the cooperation of my employers of the past eight years, G.R. Foods of Woodbridge, New Jersey, and Empacadora Nacional, C.A., of Guayaquil, Ecuador, for their commitment to the publication of this work. My personal friends and respected colleagues, Padge Beasley, Jr., and Granvil Treece also deserve special mention for critical review of the manuscript; and, most of all, I thank my wife Anita for her continual support and encouragement during the drafting of this manual.

J.R. Villalon
1804 S.E. 13th TR.
Cape Coral, Florida 33904

Contents

1	Introduction	1
2	Pond Disinfection	3
	Drying	3
	<i>Disinfection</i>	3
	Dry season disinfection	3
	Time frame for dry season disinfection	4
	Rainy season disinfection	5
	Time frame for rainy season disinfection	6
	Weir Gate Preparation	6
3	Pond Preparation	8
	Weir Gate Configuration	8
	<i>Screen size determination</i>	8
	<i>Vertical substrate maintenance</i>	8
	Fertilization	8
	<i>Fertilization procedures</i>	9
	<i>Fertilization dosage</i>	10
	<i>Time frame and dosage</i>	10
	<i>"Down-time"</i>	11
	<i>"On-line" fertilization routine</i>	11
4	Pre-Stocking Pond Confirmation	13
	Predator Evaluation	13
	Vertical Substrate Assessment	13
	Benthic Fauna Assessment	13
	Preliminary Feeding	13
	Pre-stocking Salinity Control	13
5	Postlarval Transportation	15
	Hatchery Visit	15
	<i>Postlarval counts</i>	15
	<i>Temperature control and transportation</i>	16
6	Acclimation Station Preparation	17
	Disinfection and Flushing	17
	Reservoir Tank Filling	17
	Acclimation Tank Filling Preparation	17
	<i>Dry season acclimation preparation</i>	18
	<i>Rainy season acclimation preparation</i>	18
	Oxygenation and Aeration Check	19
	Preparation for Water Parameters	19
	Activated Carbon	19
	Acclimation Feed Preparation	20
	Instrument Preparation	20
7	Postlarvae Receiving	21
	Parameter Confirmation	21
	Stocking Density	22
	Volumetric Counts	25
	Feed Schedule	25

Reservoir Tank Temperature Control	26
Acclimation Schedule and Monitoring	27
Postlarval Assessment During Acclimation	28
<i>Microscopic assessment of postlarvae</i>	28
Index of gut fullness	28
Mucus and debris on setae	28
Opacity of swimmerets and tail muscle	28
Morphological deformities	28
<i>Routine acclimation assessment of postlarvae</i>	29
Tank-Pond Equilibrium	30
Acclimation Harvest Procedures	30
Pond Stocking Dispersal	31
Survival Test Bucket	32
8 Nursery Stocking	34
Feeding Strategy	34
Water Management and Screen Size	36
Parameter Monitoring	36
Growth Monitoring	36
<i>Growth sampling technique</i>	38
9 Juvenile Transfers	40
Scheduled Transfers	40
Transfer Mechanisms	41
<i>Gravity transfer technique</i>	41
<i>Seine net transfer technique</i>	46
<i>Juvenile transfer quantifications</i>	46
Culture species segregation	47
Juvenile size segregation	50
Juvenile Transport	52
<i>Pond dispersal of juveniles</i>	55
10 Direct Pond Stocking	58
Screen Size and Water Management	58
Reduced Feeding Strategy	60
Pond Parameter Monitoring	62
Growth Monitoring	62
11 In Progress Pond Management	65
Water Management	65
<i>Establishing pond operative level</i>	65
<i>Determining water exchange capacity</i>	67
<i>Routine water exchange monitoring</i>	68
<i>In-progress pond water allowance</i>	74
Weir Gate Monitoring	75
<i>Weir board configuration</i>	75
<i>Weir screen configuration</i>	76
Feeding Strategy	77
<i>Feeding frequency</i>	77
<i>Feed dispersal</i>	78
<i>Feed ration tables</i>	78
<i>Feed characteristics</i>	80
<i>Feed quality check</i>	81
Predator Control	82
<i>Theft control</i>	84
Hydrological Parameters	84

<i>Instrument calibration and pond sampling</i>	85
<i>Hydrological parameter management</i>	87
Pond water temperatures	88
Pond water salinity	88
Pond water transparency and coloration	89
Pond water pH	89
Pond water D.O.	89
Growth Monitoring	90
<i>Routine monitoring assessment of population</i>	90
Spring or neap tide	92
Percent of gut fullness	92
Molting	93
Fungal infestation	94
Chitinous bacterial infestation	94
Antennae length	94
Gill coloration	95
Morphological disorders	95
<i>Specimen processing and preservation</i>	95
Bottom Sampling	96
<i>Benthic fauna and flora</i>	97
<i>Benthic sulfides</i>	97
<i>Presence of excess feed</i>	98
12 Final Product Harvest	99
Partial Harvests	100
Harvests for European Markets	102
Literature Cited	103
About the Author	104