9-1-1986

Pond Culture of Freshwater Shrimp, 1985

Louis R. D'Abramo

Marty J. Fuller

Jeffrey S. Collins

John M. Heinen

Michael J. Murphy

See next page for additional authors

Authors
Louis R. D'Abramo, Marty J. Fuller, Jeffrey S. Collins, John M. Heinen, Michael J. Murphy, H. Randall Robinette, John E. Waldrop, and David W. Whitten

Information Bulletin 94 September 1986

Pond Culture of Freshwater Shrimp 1985

MAFES
MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION R. Rodney Foil, Vice President and Director
Donald W. Zacharias, President Mississippi State University, Mississippi State, MS 39762

Pond Culture of Freshwater Shrimp, 1985

Louis R. D'Abramo, Assistant Aquaculture Biologist
Department of Wildlife and Fisheries

Marty J. Fuller, Assistant Economist
Department of Agricultural Economics

Jeffrey S. Collins, Fisheries Research Assistant
Department of Wildlife and Fisheries

John M. Heinen, Assistant Aquaculture Biologist
Department of Wildlife and Fisheries

Michael J. Murphy, Research Assistant
Department of Wildlife and Fisheries

H. Randall Robinette, Fishery Biologist
Department of Wildlife and Fisheries

John E. Waldrop, Economist
Department of Agricultural Economics

David W. Whitten, Research Associate
Department of Agricultural Economics

Pond Culture of Freshwater Shrimp, 1985

Evaluation of the economic feasibility of producing *Macrobrachium rosenbergii*, the giant Malaysian freshwater shrimp (prawn), entered its second year in 1985 at the Mississippi Agricultural and Forestry Experiment Station, Mississippi State University. Twenty experimental earthen ponds were devoted to freshwater shrimp research. Sixteen of the ponds averaged approximately 0.16 surface acre; the other four ponds ranged from 0.45 to 0.87 surface acre. All ponds were designed with 3-to-1 levee slopes and sloped bottoms, similar to Mississippi's commercial catfish ponds. The average water depth in all ponds was approximately 3.5 feet.

Seed stock for the 1985 research were purchased from Amorient Aquafarms, Inc., Kahuku, Hawaii. Upon delivery to Mississippi State on March 27, the postlarvae were placed in tanks in a temperature controlled greenhouse. The shrimp were nursed for 42 days in the tanks until pond temperatures reached a safe range (65°F) for stocking. On May 8 and 9, the nursed juveniles, at an average weight of 0.17 gram, were stocked into the growout ponds.

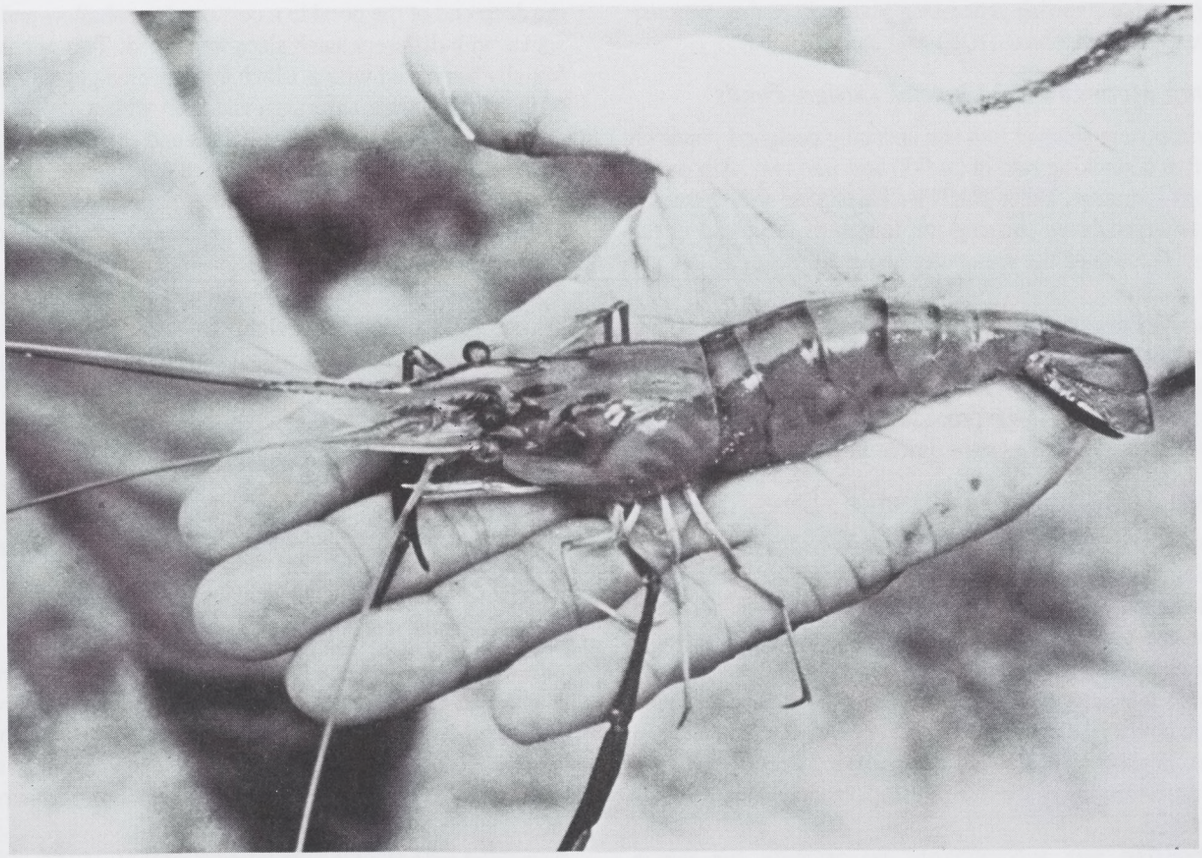
Objectives

Investigations conducted during 1985 were designed to: **(1)** evaluate the effect of stocking density on the survival, mean weight, weight frequency distribution, and yield of the freshwater shrimp in monoculture; **(2)** discover the effects of increased slope area on survival and production of shrimp grown in special-design monoculture ponds; **(3)** evaluate the potential of shrimp monoculture in the hill areas of Mississippi; and **(4)** evaluate the potential of shrimp and channel catfish fingerling polyculture.

Procedure

Shrimp Monoculture—Stocking Density

Stocking of eight ponds, averaging approximately 0.16 surface acre, occurred on May 8. Shrimp were stocked at densities of 16,000, 24,000, 32,000, and 48,000 shrimp per acre, two ponds for each density. The shrimp were fed a 25 percent crude protein pelleted, sinking feed. Daily feeding



Closeup of one of the larger male freshwater shrimp at harvest.

rates ranged from 20 percent of body weight in the early stages of growth to as low as 3 percent during the time just prior to harvest. The shrimp were fed twice daily, with feed equally distributed between morning and late afternoon feedings. Certain water quality variables, such as dissolved oxygen (DO) and temperature, were monitored twice daily, while other variables such as pH were monitored as necessary. Low dissolved oxygen (< 3ppm) or anticipated low DO was treated with emergency aeration.

After stocking, the ponds were sampled every third week with a ¼-inch square mesh seine to obtain estimates of the average weight of the shrimp. These data, along with an estimated mortality rate and feed conversion for the previous period, were used to calculate weekly feed schedules within the sampling periods.

Final harvest of the ponds began September 20 and ended September 26. Pond water levels were lowered to about 3 feet, and two seine hauls were conducted with a ½-inch square mesh seine. Ponds were then drained, and the remaining shrimp were harvested by hand. All harvested shrimp were placed into aerated tanks for 15 minutes to allow cleansing of mud from gill surfaces and appendages. Shrimp were then collected in plastic baskets and then chill-killed by submersion in ice water for approximately 10 minutes. The shrimp were then iced and transported to a facilty where they were counted, sorted, and weighed. They were taken to another location to be deheaded and size-sorted before being transported to a catfish processing plant where they were individually quick-frozen (IQF) and stored.

Shrimp Monoculture—Special Design Ponds

Shrimp were stocked into two specially designed ponds on May 8 at a stocking rate of 24,000 and into two such ponds at 32,000 per acre. These ponds were designed with a "mesa" or submerged levee running the length of the pond in the center. The top of the mesa was about 18 inches below the water surface.

The objective of this treatment was to determine the effects of increased slope area on the production and survival of shrimp. The shrimp in this treatment were managed and harvested according to the procedures previously outlined for the monoculture density experiment in conventional ponds.

Shrimp Monoculture—Hill Ponds

Shrimp were stocked in four hill ponds on May 9, two each stocking at rates of 16,000 and 32,000 per acre. This study was designed to evaluate shrimp production in the hill areas of the state by using a reservoir pond (approximately 6 surface acres) where water could be collected, stored, and gravity flowed to production ponds located down slope. The four production ponds in this treatment ranged from 0.45 to 0.87 acre in size. Shrimp were stocked and managed according to the procedures outlined for the shrimp monoculture density experiment.

Harvesting was accomplished by draining the ponds through a 10-inch PVC pipe into a "catch basin" located outside the levee. A large mesh basket was placed within the catch basin to collect the shrimp, which were then purged, bulk-weighed, and chill-killed before being transported to a facility to be counted, size-sorted, and deheaded. They were then transported to a catfish processing plant to be individually quick frozen, packaged, and stored.

Polyculture—Catfish Fingerlings and Shrimp

This treatment was designed to investigate the compatibility of catfish fingerlings and shrimp grown simultaneously in the same pond. Four 0.16-acre ponds were managed solely for catfish fingerling production, with the shrimp being a supplementary crop. The shrimp were stocked on May 8 at a rate of 2,000 per acre. Channel catfish fry (0.038-0.063 gram) were stocked at a rate of 80,000 per acre. Stocking began May 30 and was completed June 6.

The fry were fed a 49 percent protein fry starter feed until July 12 when they were switched to 32 percent protein crumbles and fed at a rate of 5 percent of the estimated biomass based upon tri-weekly samplings. Feeding was performed once a day in the late afternoon except on heavily overcast or rainy days. Water quality variables were monitored and managed as outlined for the shrimp monoculture—stocking density study.

Final harvest of the polyculture ponds was conducted October 1-4. Water levels were lowered to about 2 feet, and the shrimp and catfish were harvested by successive seining from the deep end of the pond to a corner of the shallow end. Two seines with different mesh sizes were used. Two ponds were initially harvested with a 1-inch mesh which permitted most of the catfish to pass through and then with a ½-inch mesh that removed both catfish fingerlings and shrimp. Two ponds were seined exclusively with a ½-inch mesh seine. The ponds were then drained and all remaining shrimp were harvested by hand. The shrimp were then processed according to procedures previously mentioned.

A sample of fish from each pond was counted and weighed to determine an average weight. Bulk weighings were then conducted to determine survival of the remaining harvested fish.

Results

Results of the 1985 shrimp monoculture research are summarized in Table 1. Polyculture results are summarized in Table 2.

Monoculture

In the 12 small ponds (0.16 acre each), survival averaged 87 percent, ranging from nearly 81 to more than 92 percent. The mean feed conversion rate for these ponds was approximately 3.5 pounds of feed per pound of shrimp harvested. Production ranged from 726 to 1,587 pounds per acre and increased as stocking density increased. Mean production associated with stocking densities of 16,000, 24,000, 32,000, and 48,000 shrimp per acre were 742, 1,077, 1,257, and 1,506

Table 1. Results of 1985 shrimp monoculture research.

Stocking[1] density	Pond no.	Pond size	Average harvest weight	Survival	Growout days	Biomass produced	Food conversion[2]	Yield
(no./A)		(acres)	(grams)	(%)		(lb)		(lb/A
16,000	35	0.16	25.4	80.9	135	115	3.22	726
	36	0.16	26.5	80.7	141	120	3.48	755
	B2**	0.81	41.1	49.4	141	575	4.07	717
	B3***	0.87	48.4	35.3	141	519	5.03	602
24,000	29	0.17	26.3	83.4	141	196	3.61	1,161
	32	0.17	22.2	83.3	135	165	3.21	979
	37*	0.16	18.7	92.2	135	145	3.25	913
	40*	0.16	26.0	91.2	141	199	2.81	1,255
32,000	28	0.15	20.9	86.6	138	189	3.79	1,274
	30	0.17	19.7	83.2	140	194	3.93	1,155
	38*	0.16	19.2	90.8	138	194	3.39	1,227
	39*	0.16	21.0	92.6	140	218	3.45	1,372
	B1**	0.61	26.0	65.1	133	721	4.05	1,193
	B4**	0.45	33.0	51.3	132	531	4.70	1,193
48,000	27	0.16	17.1	87.8	139	251	4.25	1,586
	33	0.17	15.0	89.9	139	239	4.07	1,426

[1] Shrimp stocked in all ponds averaged 0.17 gram.
[2] Ratio of total fed to biomass produced.
* Special design pond.
** Hillside pond.
*** Special design hillside pond.

Table 2. Results of 1985 polyculture research—catfish fingerlings and shrimp.

	SHRIMP[1]					
Pond no.	Pond size	Average harvest weight	Survival	Growout days	Biomass produced	Yield
	(acres)	(grams)	(%)		(lb)	(lb/A)
25	0.17	44.01	72.35	148	24	140
26	0.18	36.43	57.50	148	16	92
31	0.17	41.11	77.65	147	24	141
34	0.16	40.52	91.56	147	26	164

	CATFISH[2]							
Pond no.	Pond size	Average stocking weight	Average harvest weight	Survival	Growout days	Biomass produced	Conversion[3]	Yield
	(acres)	(grams)	(grams)	(%)		(lb)		(lb/A)
25	0.17	0.063	52.89	30.78	126	486	2.24	2,871
26	0.18	0.038	29.83	53.10	119	502	1.37	2,794
31	0.17	0.063	20.20	75.17	125	453	1.17	2,678
34	0.16	0.060	14.17	85.52	125	340	1.13	2,137

[1] Shrimp with an average weight of 0.17 gram were stocked at rate of 2,000 per acre.
[2] Catfish fry were stocked at rate of 80,000 per acre.
[3] Ratio of total fed to biomass produced.

Numbers of shrimp in the harvest basin below a hillside pond are monitored to determine when the basin should be lifted to purge and chill-kill the prawns.

Workers position a drain pipe to remove remaining water in a hillside pond so additional shrimp can drain into the harvest basin.

pounds per acre, respectively. Density dependent factors were obvious as average whole weight per shrimp decreased as stocking density increased. Average whole weights were 26, 23, 20, and 16 grams per shrimp for stocking rates of 16,000, 24,000, 32,000, and 48,000 shrimp per acre, respectively.

Production differences between conventional and special design (mesa) monoculture ponds were not apparent. Survival in the mesa ponds, however, was approximately 7 percent greater than that in conventional ponds at comparable stocking densities. No appreciable yield differences were apparent because of variability in average weight of the shrimp harvested in this treatment.

Monoculture—Hillside Ponds

Survival in the four hill ponds ranged from 35 to 65 percent and averaged approximately 50 percent. Production from these ponds ranged from 602 to 1,193 pounds per acre and correspondingly increased with increasing stocking density. Average whole weights for stocking densities of 16,000 and 32,000 per acre were approximately 45 and 29 grams, respectively. The average feed conversion ratio in these ponds was approximately 4.5.

Polyculture—Catfish Fingerlings and Shrimp

Survival of shrimp in the four polyculture ponds averaged 75 percent. Production ranged from 92 to 164 pounds per acre. The mean weight of the shrimp harvested from these ponds was 41 grams.

Average survival of the fingerlings in the four ponds was 61 percent, with average mean weight ranging from 14 to 53 grams. Mean weight correspondingly increased with decreasing survival.

Summary

Twelve of 16 small (0.16 acre) experimental ponds were devoted to shrimp monoculture while the other four employed catfish fingerling and shrimp polyculture in 1985. Four additional large, hill-type ponds were devoted to shrimp monoculture. The monoculture research was designed to evaluate the effects of stocking density on the survival, mean weight, weight frequency distribution, and yield of freshwater shrimp.

Survival in the monoculture ponds was excellent except for the hillside ponds. There is no readily apparent explanation for the high mortality rate in those ponds, as good water quality existed throughout the period. Sampling data suggest that significant mortality occurred during the first 6 weeks of the growing season.

With the exception of the hill area research, satisfactory results were obtained from the other treatments. Researchers believe that if these results can be validated in future replicated experiments, analysis can be conducted to adequately assess the economic feasibility of producing *Macrobrachium rosenbergii* in Mississippi.

This load of freshly dumped shrimp is ready for transport to the sorting facility.

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the Mississippi Agricultural and Forestry Experiment Station and does not imply its approval to the exclusion of other products that also may be suitable.

Mississippi State University does not discriminate on the basis of race, color, religion, national origin, sex, age, or against handicapped individuals or Vietnam-era veterans.

In conformity with Title IX of the Education Amendments of 1972 and Section 504 of the Rehabilitation Act of 1973, Joyce B. Giglioni, Assistant to the President, 610 Allen Hall, P. O. Drawer J, Mississippi State, Mississippi 39762, office telephone number 325-3221, has been designated as the responsible employee to coordinate efforts to carry out responsibilities and make investigation of complaints relating to discrimination.

28334/0.75M