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Potential of Grow-out of Softshell Blue Crabs in Ponds Stocked with Juvenile Crabs

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Abstract

Economic simulations were performed to guide the planning and managing of additional pilot experiments in softshell blue crab grow-out to maximize harvests and improve profitability. The potential costs and benefits are weighed in advance before implementing any planned changes. In making these simulations, the current information on softshell blue crab production is used. Simulations initially considered the cost of juvenile crabs as produced by private hatcheries and nurseries. Additional simulations cover the impacts of increasing survival rates and stocking density. Finally, simulations of discounted net annual cash inflows incorporated the wholesale prices of blue softshell crabs in the Mid-Atlantic markets.

Keywords: economic feasibility, pond culture, soft blue crabs, brackish water

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Introduction

This research project is a collaborative effort of several research, teaching, and outreach institutions in Mississippi and North Carolina (Perry et al., 2018). The University of Southern Mississippi, Gulf Coast Research Laboratory, in Ocean Springs, Mississippi, developed and shared its blue crab hatchery and nursery and pond grow-out research results (Perry et al., 2010; Ciurcza, 2019; Waycott, 2019; University of Southern Mississippi, 2020). The North Carolina Sea Grant Program coordinated the blue crab project with a community college aquaculture program. The Carteret Community College in Moorehead, North Carolina, conducted the blue crab hatchery and nursery, pond grow-out research activities (Schneider, 2019). The Thomas Seafood of Carteret Company in Beaufort, North Carolina, hosted the pond grow-out, shedding facility, storage, and marketing activities. The Mississippi State University, Coastal Research and Extension Center, in Biloxi, Mississippi, provided expertise in aquaculture economics and marketing to assess the economic viability of the soft blue crab pond grow-out system (Basher, 2019).

The U.S. commercial softshell blue crab landings have drastically declined since 2000. This decline in commercial softshell blue crab landings radically altered the domestic market situation for blue softshell crabs (Franze and Lively, 2018; Peveto, 2018; Brasher, 2019). The ex-vessel prices of blue softshell crab have been persistently increasing over the years, with a marked increase during the last five years after the recession and the Gulf of Mexico oil spill.

Indoor blue crab hatchery and nursery technologies have been developed over the years at the University of Southern Mississippi, Gulf Coast Research Laboratory (Perry et al., 2020). Several years of pond grow-out trials were conducted to evaluate the feasibility of growing softshell blue crabs in low salinity ponds in Lyman, Mississippi (Perry, et al., 2010; Mississippi Department of Marine Resources, 2012). A collaborative project was funded by the National Sea Grant Program to test these pond production technologies in brackish water ponds in Beaufort, North Carolina (Perry et al., 2018). Two years of pond trials produced initial results for evaluating the economic feasibility of these production technologies.

This economic analysis' overall objective is to estimate the costs of producing blue softshell crabs in brackishwater ponds. Specifically, it aims to achieve the following objectives: 1) to evaluate the operating costs of producing blue softshell crabs in a pond grow-out production system, and 2) to develop optimal economic models of softshell blue crab production systems subject to supply and technological constraints.

Methods

To produce these simulations, the North Carolina model in pond design, construction, and preparation and the Mississippi data on stocking and survival were combined to create a hypothetical blue crab farm (Table 1). The key assumptions include three crops per year and 4 quarter-acres of ponds. The stocking density is first set at 4,000 juvenile crabs per pond and then raised to 6,000 juveniles per pond. Survival rates are initially pegged at 50%.

In the initial stages of industry development, critical state and federal assistance are provided to enable the emerging industry to launch. Additional simulations cover the impacts of increasing survival rates. Finally, simulation results of production costs are compared to long-term variability in the wholesale prices of blue softshell crabs in the Mid-Atlantic U.S. wholesale markets.

Table 1. Technical Parameters for Softshell Blue Crab Farm Pond Production System

Item	Description	Benchmark
Stocking density	# of juveniles per pond	6,000
Growth rate	g/day	1.50
Survival rate	%	50
Stocking weight	g	0.25
Stocking length	mm	17.00
Juvenile crabs cost	$/crab	0.00
Average production	doz of crabs per pond per crop	250
Average production	# of crabs per pond per crop	3,000
Target wholesale price	$/doz	$17
Number of crops	# of crops per yr	3
Number of ponds	# of ponds per farm	4
Total harvest	lbs of crab per pond per crop	597
Total amount of feed	lbs of feed per pond per crop	1,406
Feed conversion ratio	lbs of feed per lb of crab	2.36
Percent of feed costs to total variable costs	%	26
Annual net returns	$/yr	4,511
Average cost	$/doz	$16

Results

The main challenges in aquaculture involved increasing efficiency in the production process, emphasizing minimizing losses by cannibalism in larviculture techniques, nutrition of larvae and juvenile, reducing impacts caused by viral diseases, and technological development of the cultivation systems themselves (Hungria et al., 2017). These observations adequately summarized the experimental trials in softshell blue crab production in ponds. Higher softshell blue crab production was achieved with higher stocking densities and higher survival rates. However, survival rates were limited due to rampant cannibalism in nursery tanks where juvenile crabs are kept for some time before stocking them in ponds.

At a lower stocking density of 4,000 juvenile crabs per pond, the average costs of production ranged from $20 to $60 per dozen of softshell blue crabs (Figure 1). As survival rate increased, the average costs of production subsequently decreased. The wholesale market prices in the Mid-Atlantic markets averaged $17 per dozen of hotel size (4-4.5 in or 2.5 oz) softshell blue crabs (Urner Barry Comtell, 2020). The net present value and internal rate of return of this simulation resulted in a rejection of this particular production system.

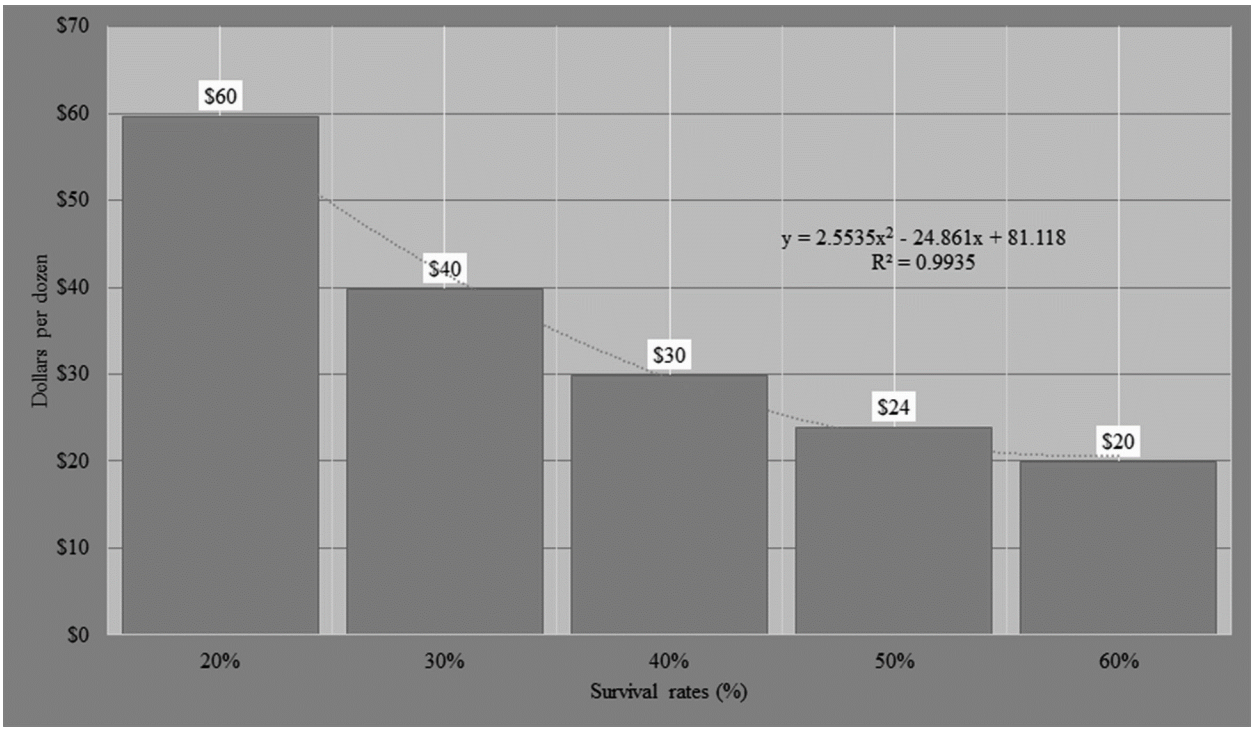

Figure 1. Sensitivity of Average Cost to Survival Rate at Stocking = 4,000 Juvenile Crabs per Pond and Growth Rate = 1.5 gram.

With a higher stocking density of 6,000 juvenile crabs per pond, the average costs of production when the survival rate is 50% was $16 per dozen of softshell blue crabs (Table 1). The wholesale market prices in the Mid-Atlantic markets averaged $17 per dozen of hotel size (4-4.5 in or 2.5 oz) softshell blue crabs (Urner Barry Comtell, 2020). The net present value and internal rate of return of this simulation led to the acceptance of this specific production system.

Summary and Implications

Simulation results at a stocking density of at least 6,000 juvenile crabs per pond and hotel-sized softshell blue crabs (4 in or 2.5 oz) at a wholesale price of at least $17 per dozen indicated that softshell blue crab grow-out in brackish water ponds could be economically feasible. Currently, alternative options are rather constrained, because the holding capacity of each pond is limited by its natural productivity, availability of local and cheaper feed, prevalence of cannibalism, and efficient harvesting methods. Other production strategies are being evaluated, such as stocking ponds with megalopae instead of juvenile crabs.

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