Estimating Economic Benefits of Allowing a Flexible Window for Maryland Purchases of Sponge Crabs

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ESTIMATING ECONOMIC BENEFITS OF ALLOWING A FLEXIBLE WINDOW FOR MARYLAND PURCHASES OF SPONGE CRABS

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Executive Summary

We estimate that crabmeat industry revenues from processing sponge crabs can increase by at least 56% over the current estimated value of production, from $1.6 million to $2.5 million. This gain can be realized by moving from the current fixed opening of the season during which the Maryland industry can purchase sponge crabs to a flexible starting date to the season that lasts the same number of days as the current system. This change would have the added advantage of reducing the variability in revenues that come from processing sponge crabs. Our modeling of the decision to open the season is based on a minimum amount of information. It is expected that with more sophisticated analysis of the market situation during the season, experts can optimize the opening date and increase the revenues even further.

Background

This study is being conducted at the request of the Maryland Department of Natural Resources to determine the economic impact of allowing for a flexible start to the sponge crab purchasing season. It is illegal to harvest sponge crabs from Maryland waters at any time. However, prior to 2002, it was legal for Maryland seafood processors to purchase legally caught sponge crabs from out of state harvesters and dealers throughout the year. In 2002, new regulations were adopted so that Maryland seafood processors were only allowed to purchase and possess sponge crabs harvested out of state from approximately April 25th - July 5th, a period of 73 days.[1] A flexible start date would allow the season to begin later than the April 25th start, but it would still end 73 days later. The rationale for this change is that it would allow the Maryland crabmeat processing industry to take advantage of market conditions that are driven by high temporal variability in crab abundance and availability in the Chesapeake Bay, North Carolina and the Gulf of Mexico.

The Maryland Sea Grant Extension Program has been conducting an annual survey of Maryland crabmeat processors since 1999. The survey conducted in 2002 which collected data on crabmeat production in 2001 was expanded to include questions on utilization of sponge crabs in order to estimate the impact of, at that time, the proposed total ban on sponge crab possession.[2] In 2001 there were 30 active processing plants in Maryland and we received survey responses from 20. Those firms indicated that they produced about 2.2 million pounds of crabmeat with a wholesale value of $23 million. In 2005 there were only 22 licensed plants remaining. These plants produced 2.4 million pounds worth $17 million. The lower value is due

[1] These dates may change slightly from year to year.
[2] D. Lipton and S. Sullivan. 2002. The Economic Impact on Maryland's Crabmeat Processing Industry of Proposed Regulations: A Possession Restriction on Sponge Crabs and Crabs Smaller Than 5-1/4 Inches. Maryland Sea Grant Extension Publication UM-SG-SGEP-2002-01. College Park, MD.6pp.

to the fact that some of the larger remaining plants produce a lot of lower value crabmeat such as claw meat.

The 2001 survey collected data on monthly use of sponge crabs as a percentage of total output (Table 1). Small plants (15 employees or less) rarely bought sponge crabs. They purchased a small amount in July and August, equal to about 6.4% of their total production. Medium size plants (16-40 employees utilized some sponge crabs from April through August with the heaviest usage of 13-16% of total production occurring from May to July. Large plants (greater than 40 employees) utilized sponge crabs from May to October, and at least for that year, the majority of their production in July (52% of the processed value) and August (67%) was from sponge crabs. In 2001, which was a relatively poor year for crabmeat production in Maryland, we estimated that crabmeat from sponge crabs had a wholesale value of $2.7 million, or 12% of the $23 million worth of wholesale production for that year. Of that $2.7 million worth of product, only 26% was purchased during the April-June period, which closely corresponds to the current period when sponge crab purchases are allowed. Based on 2001 blue crab availability and market conditions, the sponge crab purchase ban would have gone into effect just at the time in the season where crabmeat processors were looking to significantly increase their purchase of sponge crabs to augment their production.

Methodology

We employ a stochastic simulation technique (Monte Carlo modeling) using 2001 baseline production data updated to 2005 prices to determine the potential difference in industry income when comparing a fixed period of sponge crab purchases from April 25-June 5, as opposed to a floating 73-day window in which purchases are allowed. To simulate the variation

of sponge crab purchases during the fixed 73-day period, the daily production is modeled as a triangular probability distribution where the most likely value is derived from the monthly 2001 production. April daily production is modeled as a triangular probability distribution with a minimum daily value of zero, a most likely value equal to the price adjusted daily average for April from the 2001 survey, and the maximum value equal to the daily maximum observed in 2001. May production levels use April's most likely values for the minimum, the May average from the 2001 survey as the most likely value and the maximum from the 2001 data. Other months follow this pattern. A complete list of the parameters of the triangular distributions is presented in Table 2.

Monte Carlo simulations were run using the above triangular probability distributions of production for 1,000 randomly generated iterations, with production restricted to the April 24-July 5 period[3]. In a second simulation, the start of the season was allowed to randomly vary between April 24th and June 21st. June 21st was chosen as the latest date that the season would open so that the 73 day period would end no later than September 1. The 58 days between these two dates represent the dates on which the sponge crab purchasing season might begin. We used a random number generator to determine which of these 58 days the season would begin and then ran 1,000 simulations to determine the expected revenues. This latter scenario represents a naïve decision-making process for season opening, and thus represents a minimum improvement over what might be expected if the decision to open the sponge crab buying season was based on observations of crab landings and other market conditions.

The third scenario tries to capture at least part of the process for how a season opening might be determined based on information that the crabmeat processing industry and Maryland

[3] A software program that works with Microsoft Excel spreadsheets called @RISK was used to perform these analyses

DNR might gather as the season progresses. For this scenario the program keeps track of the potential production each day that is being estimated by the triangular probability distribution. If the sponge crab season were open, this is the amount that the program is estimating would be purchased on that day. When the sum of the daily potential production that is not being purchased because the season is closed exceeds a threshold, purchasing begins the following day. Since it is not known what the threshold might be, this was also modeled as a triangular distribution with a minimum value of $650,000, a most likely value of $900,000 and a maximum value or $1,000,000. This distribution tends to push the season opening later in the year, but was chosen because it never exceeded the maximum allowed opening date of June 21st.

Results

The status quo scenario simulates the crabmeat industry producing crabmeat from available sponge crabs from April 24th -July 5th. Mean production value for crabmeat from sponge crabs was approximately $1.6 million. When the season start date was chosen randomly, the mean production value from the simulations was $2.2 million. The scenario in which the industry chose the starting date based on the cumulative potential sponge crab production as the season progressed resulted in an average mean production value from sponge crabs of $2.5 million. The mean starting date for the industry selected starting date was 46 days into the season, or around June 8th. The starting date ranged from as early as May 25th and as late as June 21st.

In addition to the benefit of an overall expected increase in industry revenue of $600,000 with a random season opening and $900,000 from a season opening chosen with market information, the industry also benefits from decreased variability in revenues. The coefficient of

variation (CV) is the ratio of the standard deviation to the mean and is a measure of the dispersion of the results. In the fixed window scenario, the CV is 5.3%. Not unexpectedly, the scenario when the opening day is selected at random has the highest dispersion in results with a CV or 16.8%. The scenario when the opening date is selected according to our decision rule has the lowest dispersion with a CV of 3.8%

Summary and Conclusions

Even a random opening date of the sponge crab purchasing season performs better in a simulation than the current fixed opening date. When the industry or some organization is allowed to select the opening date based on market information they are collecting they outperform both the random date opening and the current fixed date system. This is not surprising because they always have the option of selecting the current opening date in the random and selected opening date scenarios. They should be able to do at least as well as the fixed opening system. We estimate that the increase in industry revenue from adopting a flexible opening is about $900,000, an increase of 56% over the status quo.

Table 1. Percentage of monthly crabmeat production due to sponge crab use in different size Maryland crabmeat processing plants in 2001. Total value of production was $2.7 million.

	Apr	May	June	July	Aug	Sept	Oct	Nov
Small Plants	0%	0%	0%	6.4%	6.4%	0%	0%	0%
Medium Plants	0.7%	14%	16%	13%	6.7%	0%	0%	0%
Large Plants	0%	13%	28%	52%	67%	3.6%	1.6%	0%

Table 2. Parameters of triangular probability distributions of daily potential value of crabmeat production from sponge crabs.

	April	May	June	July	August
Minimum	0	366	6099	20935	39964
Most Likely	366	6099	20935	39964	47558
Maximum	47558	47558	47558	47558	47558

Table 3. Results of status quo, random starting date, and industry-selected starting date on industry revenues from sponge crabs. (In million dollars, CV=coefficient of variation.)

	Minimum	Mean	Maximum	CV
Fixed Opening	$1.4	$1.6	$1.8	5.3%
Random Opening	$1.4	$2.2	$2.9	16.8%
Selected Opening	$2.2	$2.5	$2.8	3.8%