Designing a License Buy Back Program for Maryland's Blue Crab Fishery: Limited Crab Catcher Licenses

Geret DePiper
Doug Lipton

Department of Agricultural and Resource Economics
University of Maryland
College Park, MD 20742

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Introduction

The State of Maryland is considering a license buyback program for the Limited Crab Catcher (LCC) license in the Maryland blue crab fishery. The LCC license allows a fisherman to fish up to 50 crab pots. Recently, bushel limits for female crabs have been put in place for LCC license holders as follows:

- April 1 through May 31- 2 bushels of females per day
- June 1 through June 15 – no female harvest
- June 16 through August 31 - 2 bushels of females per day
- September 1 through September 25 – 10 bushels of females per day
- September 26 through October 4 – no female harvest
- October 5 through November 10 – 10 bushels of females per day
- November 11 through December 15 – no female harvest

The LCC license has an annual cost of $50. The license can be temporarily transferred to another fisherman during the year, it can be permanently sold to another fisherman as part of a sale of one's fishing business, and it can be inherited from a family member.

The State of Maryland Department of Natural Resources (DNR) is considering two options for a license buyback program. One option is to determine a price at which the state will buy back licenses and then purchase as many licenses as possible with the given budget. A second option being considered is to hold a reverse auction in which license holders provide bids as to the amount they would be willing-to-accept to permanently give up their license. The State would then pay off the lowest bids until the budget is exhausted. Since concern was expressed about perceived inequities in a reverse auction price due to the fact that individuals would receive different payments for the same license, a third option is suggested, a reverse auction with a uniform payout.

In the analysis that follows, we make our best attempt to estimate a distribution of willingness-to-accept for likely participants in a buyout. . We then assume that our estimated distribution of willingness-to-accept is the correct one and demonstrate the difference in licenses purchased and expenditures using a reverse auction and a uniform payout reverse auction. We compare those results to license purchases and expenditures when we underestimate the pre-determined payment amount and overestimate the pre-determined payment amount. The reverse auction is the most efficient approach although the amount that it out performs other approaches is a function of our assumed distribution. Underestimating the single payment is not wasteful; it simply results in many fewer licenses being purchased. Guessing wrong and overestimating the single payment amount is the least efficient approach Because of the low level of confidence in these estimates due to the paucity of the type of data needed to make such an analysis, we recommend that a reverse auction be held, which in fact is the best way to reveal license values

Calculating the Value of a License

With normal market goods we can determine their value to individuals by observing the amount of a good that is purchased at varying prices over time. At higher prices, fewer people would purchase the item and people that do purchase may buy a smaller quantity. This is how market demand is determined. Market demand is the aggregation of each individual's willingness-to-pay for the good.

If the price of a fishing license had varied significantly over time, we could use that information to estimate the aggregate willingness-to-pay. But since the price has remained constant (at least in nominal terms), it provides almost no information about the distribution of willingness-to-pay over the fishermen population. The annual total willingness-to-pay for some individuals may only be $51 leaving them a net benefit of $1.00 after the cost of the license is subtracted. Or willingness-to-pay could be $500, leaving that individual a net benefit of $450.

If the LCC license were truly a commercial fishing license, we could treat each license holder as if they were a profit-maximizing business and then utilize cost and return information to approximate the license value. For example, if we calculated that license holders earned an economic profit (i.e., a return over and above the opportunity costs of all inputs used in the fishing enterprise) of a $1,000 per year, then we could calculate a net present value for the license. Using for illustrative purposes a 10 year time horizon and a 3% discount rate, the license would be valued at $8,530. Theoretically, one could raise the 10-year cost of the license to that amount and the individual would be indifferent between fishing and not fishing.

In analyzing the data regarding license utilization and harvest in the four representative years provided to us by DNR (1996, 1997, 2001, 2004) we concluded that a large number of these license holders are not involved in a commercial enterprise. Based on an analysis of part-time crabber variable fishing costs (Rhodes et al. 2001) of $87.10 per day, and a price per bushel of $67.84 during bad harvest years (2001, 2004), and $52.89 in years with good harvests (1996, 1997), we created a rule that fishermen averaging less than 2 bushels per day harvest were engaged in mostly non-commercial harvest. That is they purchased their license mostly for the recreational benefits they would obtain from it, or for some other reason such as option value for future commercial harvest or bequest value to a family member. This is illustrated in figure 1 which shows a relatively high percentage of license holders in 1997, a good harvest year, had zero or a very small catch during the season.

We were unable to find in the literature any references for studies of recreational fishing for crabs. A paper by Whitehead et al. (2002) on recreational fishing values for commercial finfish license holders (without an endorsement to sell) calculated a mean willingness-to-pay of $79.65 per annum. We used the Whitehead et al. literature value as an indicator of what Maryland limited crab catchers' net economic benefit from possessing the license might be. We then assumed a ten-year time horizon and applied an OMB (http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/) recommended 2.4% discount rate to determine a mean for license net present value, $717.55.

While we now have an estimate of the mean license value, we do not know what the distribution of values is around that mean. A distribution of WTA for these recreational fishermen was generated using average number of days fished by the recreational fishermen as a proxy for utility. The assumption is that individuals gaining higher utility from the license will fish more often, and thus attribute a higher value to the license itself. The variable capturing the average number of days fished by each fisherman over all four years was broken into deciles. The decile containing the mean number of days fished was awarded the mean WTA of $717.55. Each decile below this mean decile had $125 subtracted from the value of the license, while each decile above the mean had $125 added to the value of the license. This corresponds to a range of WTA values from $92.55 to $1,217.55. A representative distribution of these values can be seen in Figure 2 below which is based on a combination of all the years. The distribution in Figure 2 is essentially a uniform distribution with some variation in the numbers per decile due to ties in the data. Similar distributions were created for the average of the two good harvest years (1996, 1997) and the two bad harvest years (2001, 2004)

Figure 1. Cumulative percentage of LCC license holders by total catch in 1997.

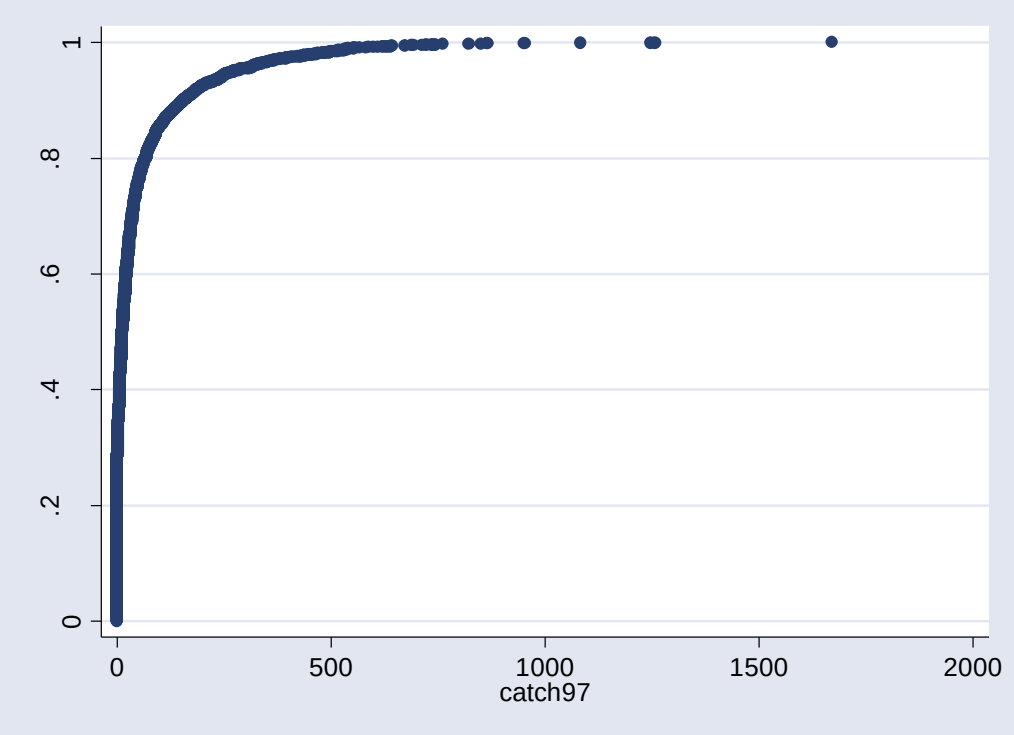
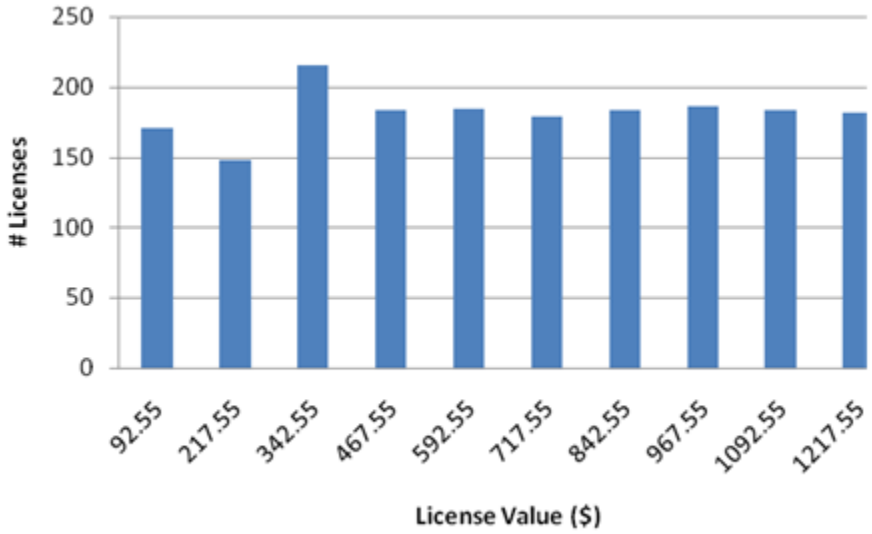


Figure 2 An assumed distribution of the number of license holders by estimated license value for an average of good and bad harvest years.



Simulations

All the information about the performance of a buyback program is represented in Figure 2 and the corresponding distributions for good and bad harvest years. If for a moment we consider this to be the true distribution of LCC license holder's license values, then we can simulate how they might respond in a reverse auction market.

Focusing on the mixed year scenario results, we can see that a reverse auction with a $1.5 million budget could buyout 2,166 licenses. If we hold the reverse auction to discover the distribution of bids and set a uniform price, we would have purchased 1,550 licenses at approximately $968 (Table 1). If we were instead to underestimate the price necessary to purchase licenses given our budget, we would still buy out 1,233 licenses, but we would still have funds left over for another round of buyouts. On the other hand, if we pick a price that is too high by $250 compared to the reverse auction uniform payout, we will buyout 269 fewer licenses and exhaust the budget.

Surprisingly, there was little difference between the good harvest year scenarios and the blended scenario of good and bad years. Results differed greatly, however, between the good/mixed scenario and the bad harvest year scenario. The difference in these results demonstrates how the success of the buyout program will depend on how optimistic or pessimistic license holders are about future harvests.

Recommendations

A sealed bid reverse auction embodies the single best process by which to uncover the true value of, and maximize the effectiveness of a license buyback for, LCC licenses in Maryland. In a reverse auction license holders directly announce the price at which they are willing to sell their licenses, insulating the auction from data limitations which might bias any attempt to indirectly estimate these license prices. The sealed bid component is important in ascertaining an individual's true value of the license such that it is uninfluenced by the bids of other license holders. In this way individual license holders are paid exactly the value that they place on the license, which in essence is what the license is worth. Coupled with the voluntary nature of the buyback, this process ensures a fair price to license holders while simultaneously maximizing the number of licenses Maryland DNR is able to buy.

Instituting a price ceiling for any single license is a way of ensuring that no license holder receives an exorbitant payout as compared to other accepted bids. A price ceiling represents a threshold by which any bid higher than the ceiling is rejected outright. In addition to concerns for equity, a price ceiling will help Maryland DNR utilize funds in an efficient manner by allocating money towards projects with the highest marginal returns. However, communicating a specific ceiling is likely to bias bids towards the ceiling and reduce efficiency. To avoid this we recommend that the actual bid data be used to determine the ceiling. One recommendation discussed was that the ceiling be no more than two standard deviations from the mean of accepted bids at a particular point. For example, if the mean bid is $500 with a standard deviation of $250 at a point where $1 million of the budget is exhausted, the bid ceiling would be calculated to be $1,000. It will be important to communicate during the process that Maryland DNR will impose a ceiling based on actual bids received to ensure that the difference between the highest accepted bids and mean bid is not excessive. In addition, any other information about planned changes to the LCC license should be communicated to the bidders, as this may impact their bids.

Reverse auctions have a proven track record in effectively facilitating fishery buyback programs ranging from the Texas Parks and Wildlife commercial bay and bait shrimp fishing boat licenses buyback (Riechers et al. , 2007) to the Northeast Groundfish Fishery vessel buyout (Walden et al., 2003). The simulations summarized in Table 1, coupled with the arguments put forth in these recommendations, confirm that a sealed bid reverse auction will serve as the most efficient means of conducting a buyback of LCC licenses in Maryland and remove latent capacity from the commercial blue crab fishery. In turn, this reduction in latent capacity will ease the management of the fishery towards conservation goals.

Table 1. Simulation results comparing a reverse auction, a reverse auction with uniform payout, underestimated fixed price and overestimated fixed price.

Good year scenario

	Reverse Auction	Reverse Auction with single price	Underestimated single price	Overestimated single price
Total # LCC Licenses bought	2119	1550	1188	1231
Price of LCC Licenses	N.A.	$967.55	$717.55	$1,217.55
Total Cost of LCC Licenses	$1,498,413.79	$1,499,702.50	$852,449.40	$1,498,804.05

Mixed year scenario

	Reverse Auction	Reverse Auction with single price	Underestimated single price	Overestimated single price
Total # LCC Licenses bought	2166	1550	1233	1231
Price of LCC Licenses	N.A.	$967.55	$717.55	$1,217.55
Total Cost of LCC Licenses	$1,499,431.75 $	1,499,702.50	$884,739.15	$1,498,804.05

Bad year scenario

	Reverse Auction	Reverse Auction with single price	Underestimated single price	Overestimated single price
Total # LCC Licenses bought	2554	1780	1737	1231
Price of LCC Licenses	N.A.	$842.55	$717.55	$1,217.55
Total Cost of LCC Licenses	$1,498,917.50	$1,499,739.00	$1,246,384.35	$1,498,804.05

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