THE LOTTERY AND RESOURCE ALLOCATION:
THE McNEIL RIVER STATE GAME SANCTUARY

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I. McNEIL RIVER STATE GAME SANCTUARY --- BEARS!

The McNeil River State Game Sanctuary in Alaska is one of the most unique wildlife viewing phenomena in the world. It provides an unsurpassed opportunity for observing and photographing the Alaskan Brown Bear. The Alaskan Brown Bear or grizzly (ursus arctos), in general, is seldom seen in large groups. However, at the McNeil River falls, a cataract where bears can feed on spawning salmon, as many as sixty bears have been observed at a single time. The unusual tolerance of humans shown by these bears and an ideal viewing platform adjacent to the falls further enhances this spectacle. The experience of viewing these bears is truly a unique experience, and consequently is in high demand by the public.

However, the supply of this phenomena is limited. Experience has shown that the McNeil bears ignore small groups visiting the falls, but there is a limit to their tolerance. Over time the sanctuary managers have concluded that a maximum of ten (10) persons at a time visiting the viewing area is an optimal number of visitors. Any more visitors would not assure the sustained opportunities to view, photograph, and study the bears.

This has set up a classic example of a problem in the allocation of scarce resources. There is a limit on the number of persons that can visit the sanctuary and this limit is far less than the number of persons who want to visit the sanctuary. The managers of the sanctuary, the Alaska Department of Fish and Game (ADF&G) have divided the season when the bears visit the falls into fourteen periods, for each of which they issue ten permits for visitation. Thus, there are 140 permits. In 1986 there were 806 applicants for the 140 permits. In 1987, as a result of two national television programs in which the sanctuary received publicity (A National Geographic Special: The Grizzlies and the Wild America Series: The River of the Bears) the number of applicants increased to 1646. In 1988 and 1989 the number of applicants were 1049 and 1305 respectively, with the number of possible permits remaining constant at 140. This presents a classic case in which it is possible to study the costs of alternative methods of resource allocation.

Prior to 1974 access to the sanctuary was uncontrolled. As the number of visitors increased there was a marked change in the behavior of the bears at the falls and in the number of bears that visited the falls. In 1974 the Alaska Board of Game adopted a permit system in which permits were allocated by lottery. The remote physical location of the sanctuary allows the permit system to work fairly well, with respect to being able to control the numbers of visitors.

This method of allocating permits has worked. However, not all are satisfied with the method and there are costs associated with this method that are not immediately evident to the casual observer. Additionally, with the growth in demand for the permits, it is desirable to understand the ramifications of any particular allocation scheme, as well as examine other allocation schemes. Every rationing scheme affects both the administrators and the users differently, and it is imperative to understand these impacts from the standpoint of ease of administration, acceptability to the users, efficiency, and the affect on user behavior.
In addition to the above concerns, different allocation mechanisms have implications toward the financial position of resource management agencies. Numerous state fish and wildlife management agencies in the U. S. have experienced severe financial problems recently. Tight budgets have increased the pressure on these resource agencies to conduct economic assessment of policies involving resource use. Traditional economic theory and economic thinking has, for the most part, not been part of the decision making process in wildlife management. Economic theory needs to be integrated into the decision making process, as wildlife management is really a synthesis of biological and social sciences. Understanding demand theory provides insight into the notion of revenue structures and is potentially important in the debate of the actual allocation schemes, fees, and prices eventually adopted. Obviously, the principle objective of wildlife management agencies is not to maximize revenue, but revenue generation and revenue capture are important elements of many policy decisions.

During the summer of 1986 all of the visitors to the bear sanctuary were surveyed, as well as all of the unsuccessful applicants. With this information it is possible to gain understanding in terms of the costs and benefits of the current allocation scheme, as well as provide insights into alternative schemes.

The focus of this paper is to assess and analyze the economics of the lottery mechanism in light of traditional demand theory, using the McNeil River Bear program as a case study. The first section of the paper is a description of the lottery mechanism utilized by ADF&G at McNeil. The second section is a discussion of the allocation of visitor permits as it relates to demand theory and a lottery mechanism. Section three examines the rationale of using market-like alternatives for allocating wildlife resources. Section four is the analysis of the 1986 survey of lottery participants, where the economic impacts of the lottery mechanism are quantified. The last portion of the paper presents some policy recommendations.
II. THE CURRENT LOTTERY MECHANISM

The bears begin arriving at McNeil to fish for salmon in early July, and leave the area after mid-August. Entry to the viewing area is strictly controlled and limited to 10 visitors per day during the period of July 1 through August 25. The period between 1 July and 25 August is divided into fourteen four day periods (each given alphabetic designation A thru N) and permits are issued to individuals and groups for each of the slots. Thus, there are 140 individual permits which are available for the lottery. The largest concentration of bears is normally during the period of July 15 to August 7, though bears are present throughout the whole period. During one period (H) three permits are reserved for scientific/educational purposes, so only seven permit are available for the permit drawing. Additionally, the prospective lottery participants are cautioned that the number of bears at the falls diminishes drastically after mid-August, so that viewing opportunities during this period are likely to be disappointing.

Applications for the drawing must be received in Anchorage by April 1, with the drawing being held later in the month. Each applicant is required to pay a $10.00 fee to submit an application, and an additional $40.00 as a use fee, which is refunded if the applicant is not successfully in the drawing. Prior to 1987 permit winners were not required to pay any permit fees; the only fees that were collected were derived from the lottery application ($5.00). Beginning in 1987 the winners of the permits were required to pay a "user fee" of $40. The successful applicants were notified by mail that they had won the lottery and that a remittance of $40 was necessary to obtain the permit. In 1988 the applicants were required to submit $40 with their application.

The applicants indicate two of the fourteen designated time blocks. A lottery is held for each time slot, and if an individual is not drawn in their preferred time slot they then have a chance at being drawn in their second choice. So the probability of being drawn can vary significantly, depending on the individual's preferred time slot.

Group applications are also permitted, with the maximum size of a group being three. Each group must pay the $10.00 per person fee, as well as the $40 use fee, if drawn. There is a risk in the group application; if a three person group were drawn for a particular time slot and eight permits had already been drawn for the time slot, the group permit is eliminated from consideration. Groups greater than three are not permitted.

Permits are not transferrable or assignable. The permit holder is entitled to visit the falls viewing area, accompanied by an appropriately equipped refuge biologist, during the specific four day period indicated on the permit. The permit is only valid for the four day period, irrespective of weather or other conditions.

There is also a provision for standby visitors. Every day during the viewing season visitors accompany the field guide to the falls viewing area. In the event that all ten of the permit holders do not chose to visit the falls (either they are in camp
and chose not to go, or are not in camp) standby visitors are allowed to visit the falls, according to a predetermined formula worked out by the managers. Individuals are not allowed to transfer their permit.

In the event the original permit recipient does not go to the falls permits are allocated on the basis on a queue, the person that has been waiting to visit the viewing area the longest has the first option to visit that day. In the event that people have been in camp the same time a specific formula is used. Individuals are allocated points on the basis of the number of days in camp divided by the number of visits to the falls. Thus, someone who had been in camp for three days and been to the falls once would have a point value of three, and would have a lower priority than someone who had been in camp only one night and had not visited the falls.

Thus, individuals are able to visit the falls by either drawing a permit or waiting in a queue at the camp ground. Each year some one hundred and fifty persons visit the viewing area for the falls. The current program successfully limits the number of people visiting the viewing area so human disturbance is at a minimum. However, the method by which the visits are limited has significant ramifications for the management of the sanctuary (from both a biological and fiscal perspective), for the satisfaction of actual and potential visitors, and the taxpayers of the State of Alaska for implicitly funding the operations of the sanctuary. This method, as well as alternatives, needs to be examined in an economic context, to see if better methods exist and what trade-offs exist. Economics and demand theory provide insights to these methods.
III. VISITOR PERMITS AND DEMAND THEORY

Visiting the McNeil River Bear Sanctuary is an economic good and is similar to other goods and services that people desire. The more costly a good in terms of the things that must be sacrificed to obtain the good the less of a good people will want. If the rights to visit the bear sanctuary were sold on a market, the lower the price, the more people would want purchase the right, and the higher the price the fewer people would want purchase the right. There is no reason to expect that people would behave any differently toward visits to the bear sanctuary than they would toward any other scarce economic good. Visits to the McNeil River State Game Sanctuary are a scarce economic good---there are not enough visits to satisfy all those who want them.

Traditional demand theory asserts that when people purchase goods, they feel the value of the good purchased is greater than what they give up to obtain the good. As long as an individual values the good (visit to the sanctuary) more than the price of the permit (that which is given up to obtain the permit) the permit will be purchased. Those who place a high value on the permit would purchase it, and those who place a low value on the permit would not. There is the marginal individual whose excess value (over and above the purchase price) who is just enough to entice them to purchase the permit. Those who value the permit less will not purchase it. Thus, the market allocates the scarce commodity to those who place the highest value over and above the clearing price. when an individual purchases a good and only money is sacrificed, the value of that good to that specific person is greater than any alternative use of that money.

However, price is not the mechanism that is used to distribute the rights to visit the bear sanctuary. The mechanism used to determine who obtains the scarce good is a lottery. A lottery is thought to be an egalitarian mechanism because all participants are given an equal probability of receiving the visitation rights. However, this may not be the case. Economists are critical of a lottery as a distribution mechanism for two reasons. First, the lottery assumes that everyone in the lottery places equal value on the resource, and the lottery distributes the resource at random. Thus, some individuals who place a low value on the resource displace individuals who place a high value on the resource. There is misallocation; a loss results because resources are not allocated to the highest valued uses. Secondly, the lottery mechanism may involve substantial elements that significantly reduces or dissipates the net value of the resource.
A. Misallocation of Permits by Lottery

The misallocation that results from the lottery can be explained by considering that the demand for the permits represents the different values that individuals place on the visiting the sanctuary. In the year of the survey 806 person entered the lottery for the permit, in a process in which they knew there was no certainty of winning. Each person in the lottery was willing to expend $10 for a chance at winning the permits, plus pay an additional $40 if they win in the lottery. The value that people placed on the permits can be inferred from the expected value of a lottery ticket—the value of a permit multiplied by the probability of winning a permit is equal to the price of the lottery chance plus the $40. This would suggest that all lottery participants were willing to pay and placed a value of at least $99 for a permit (this is a somewhat heroic assumption, in that it assumes that all participants know that the probability of winning a permit was 140/806 = 0.17). The $99 was a minimum value for the permits; some individuals placed a higher value on the permits, but all valued the permits at least $99.

Although there is nothing to suggest the maximum price that anyone would pay, for purposes of illustration assume that the maximum price were $499 ($400 greater than the minimum value anyone who plays the lottery), and everyone would be willing to pay at least $99, and that the relationship between the two points is linear (Fig. 1). Since the lottery distributes permits at random, it would be expected that the mean value of the winners of the lottery would be $299, for a total value of $42,860 (Fig. 1, area OBFH). Whereas, if permits were allocated to the 140 individuals who placed the highest value on the permits the cutoff value would be $430, and the total value that all the recipients would place on their permits would be $65,110 (Fig. 1, area ODEH).

The difference of $23,170 (Fig. 1, area BDEF) between the two total value amounts, assuming the above hypothetical demand curve, represents the loss in value that results from the lottery mechanism being used to distribute the permits. This amount is a loss to society that results from resources not being used where they are valued the highest. It is a wealth loss for society that could be eliminated by distributing resources differently. It would be no different from the loss of wealth from employing a brain surgeon to dig holes for fence posts, or using gold to line sewer pipes. The actual estimates of the losses will be made below, but the loss calculated in the example above of virtually 1/3 of the value of the permits is in the range of the actual estimates of the social loss that results from misallocation. This suggests that 1/3 of the value of the resources is wasted as a result of misallocation that arises from using the lottery as a distribution mechanism.

Additionally, the resource managers would capture $60,200 in revenue (Fig. 1, area OCEH). Whereas, with the lottery as the allocation mechanism, the total revenue that would be captured by the resource managers would be $13,660 ($10 for each of the 806 lottery participants and $40 for each of the 140 permit winners.
Figure 1. Hypothetical Demand for Permits
B. Dissipation of Value and the Lottery

To gain insights into why the lottery dissipates the net value of the resource it is instructive to examine other mechanisms. Imagine that the rights to visit the sanctuary were distributed using a queue. The rights to visit the sanctuary would be distributed at a specific location starting at a specific time (for example, at the Alaska Department of Fish and Game offices in Anchorage on May 1 at 1:00 pm). There are 140 permits (for simplicity assume that all permits are of equal value). Exactly one hundred and forty people would be in the queue at the specific distribution time. Compared with a price mechanism, rationing by waiting generally entails a different resource cost—the time spent in the queue. This is thought, by many, to be an egalitarian method of distribution since all individuals have equal amounts of time to spend in the queue. Additionally, the provision of goods free of charge (in a queue) is often justified on grounds that the action will benefit the poor. Indeed, the poor actually have a lower time cost, and therefore a lower cost of waiting. But the poor end up spending more time in the queue, thus wasting resources (alternatives given up by spending waiting time) that cannot be recovered.

A queue is recognized as a mechanism which dissipates (wastes) the net value of a good over and above the price that a person would pay if the good were allocated by the price mechanism. The reason the queue dissipates the net value of the good is that people spend whatever time is necessary in the queue to gain priority. For example, suppose someone were to give away money at some specified place and time. The first person in the queue would be someone with a low waiting cost; they would calculate what wage rate at which they would wait and then enter the queue at the appropriate time. If $100 bills were being given away and a person were willing to wait for $5 per hour they would queue up (or check to see if the number of people in the queue were equal to the number of $100 bills available) 20 hours prior to the distribution time. The $100 would not be free, it would cost each of the people in the queue their waiting time. Individuals in the queue would spend $100 worth of their waiting time to obtain the $100.

If something other than money were distributed by means of a queue people would be willing to spend waiting time in the queue to obtain the good. If, for example, the rights to visit the McNeil River State Game Sanctuary were distributed by means of a queue people would start entering the queue based upon the value they placed upon the permit and the value of their waiting time. The more they valued the visit to McNeil River the more time they would be willing to invest their waiting time. At some point the number of people in the queue would equal the number of permits available. The last person who entered the queue would end up waiting the least amount of time: all others who had queued up earlier would wait a longer period of time. The value of the permits is said to be dissipated in that all of those in the queue would have spent time in the queue in excess of the time spent by the last person in the queue who received a permit. If everyone in the queue could have been costlessly informed as to the minimum time necessary to obtain the permit they would not have spent excess time in the queue. However, they spent their waiting time in the queue in order to establish property rights for the permit. The permits, in this case also, are not free. Each person spent time in the queue equal to the value that they
place on the permit. Every one in the queue would spend time resources that could not be recovered. The time spent in the queue is not transferred or received by anyone, it is lost, wasted, or dissipated.

A lottery is similar to a queue, in many ways. Before examining the lottery system used with the visits to McNeil River, it is instructive to examine a more simple lottery. For example, suppose a $100 bill were to be given away by lottery. Without knowing exactly how many, it can be safely hypothesized that a large number of people would enter the lottery. The probability of winning the lottery would be 1/n, where n is the number of people who entered the lottery. If this lottery were held over and over (for example; on an annual basis, like the permits to visit the bear sanctuary) people would continue to enter the lottery as long as their costs of entering the lottery were less than the expected value of winning. By costs here is meant the alternatives given up because they spend time involved in gathering information about the lottery, as well as time and energy spent entering the lottery. If the cost of entering the lottery exceeded the expected value of the lottery ticket (1/n x $100) people would not enter the lottery. People would continue to enter the lottery if the reverse were true. On average the resource expenditures of all the entrants to the lottery would be $100, if fully informed about how many people were entering the lottery. If few people entered the lottery, then the probability of winning would increase, causing more people to enter the lottery during a subsequent round. If, on the other hand, many people were entered in the lottery, then the expected value of a lottery ticket would be less than the transaction costs of entering the lottery, thus fewer people would enter the lottery in the subsequent round. The $100 would be given to one individual for "free", but all who entered the lottery would spend resources equal to the value of the "free" $100. The value of the $100 would, thus, be dissipated or wasted in resources spent on entering the lottery.

In the case of the lottery for permits to visit the McNeil River State Game Sanctuary, 140 permits are distributed "freely" by means of a lottery. Just as with the simple lottery described above, the value that people place on the permits to visit the bear sanctuary is dissipated or wasted in resources spend entering the lottery.

Everyone who participates in the lottery, if drawn, has to pay the $40 use fee. Additionally, every lottery participant is required to pay $10 just to be in the lottery. Thus, everyone who participates in the lottery is willing to pay at least $50 for the permits. In 1988 at least 1600 persons were willing to pay at least $50 for the right to visit the sanctuary, yet only 140 people were drawn. Each entrant knows that they have a low probability of receiving a permit (actually they don't know exactly how many entrants there are, but they know that the number of entrants is large and there is information available as to the number of entrants in the lottery in previous periods).

Each individual who enters the lottery has their own estimation of the value they place on the permit to visit the sanctuary. Also, all those who enter the lottery would pay at least $50, if the permits were sold in a market setting. Some individuals would be willing to pay substantially more than the $50 that they would end paying if they were drawn the first time they played the lottery.
They know that they have a low probability of receiving a permit in any specific period, yet they know if they play the lottery enough times they will eventually be drawn. If they played the lottery for 20 years the probability that they would be drawn to receive a permit in the lottery is 83.98 percent (assuming that 1600 entered every year), although it is not certain that they will be drawn. The number of times that an individual is willing to enter the lottery is related to the intensity of their desire to visit the sanctuary. Even if they placed an extremely high value on visiting the sanctuary there is nothing they can do to guarantee they will receive a permit, aside from entering the lottery until they eventually receive the permit. Each time they enter the lottery they incur transaction costs: the entry fee (now it is $10, though prior to 1985 it was $5), along with time cost of writing or calling ADF&G to obtain the information on the lottery procedure, as well as analyzing the information on the lottery procedure, as well as costs of filling out their application, as well as the time cost of sending in their application, as well as the cost of uncertainty of making plans that are flexible enough to be able to accommodate a visit to the sanctuary if they are drawn, as well as the anxiety that should some emergency arises which would necessitate their foregoing their visit, they would need to play the lottery the next year.

All of these transactions costs are incurred every year the individual enters the lottery. These are costs that are incurred over and above the $40 cost of the permit once it is obtained. And these costs are incurred annually until the individual either draws on the lottery or decides that they have paid enough without any return. Each year the probability of winning remains at 140/1600 (8.750, only applying annually for a large number of years does the probability of drawing approach one (1-(.9125)^N). There is no guarantee that any individual will ever receive a permit. On average, it would take an individual 12 years of playing the lottery, though some people win their permit in far less time, and some individuals it may take much longer (assuming that the pool of applicants remains at 1600). There is nothing that prevents the pool of applicants from growing over time (and that is exactly what has happened), and thus an individual's chances in the lottery may diminish over time, so an individual may start out thinking that the expected time that they would have to apply might be 5 years, and in actuality it may take 15 years to obtain a permit, all the time incurring transactions costs.

The individual starts off, as in the simple lottery above, having an estimation of the probability of winning, and an estimation of the value of the permit. As long as the expected value of the lottery ticket to them exceeds their transaction costs (time and energy playing the lottery plus their $40 permit expense), they will continue to play the lottery. Assuming that the individual ignores historical or the sunk cost of lottery games played unsuccessfully, they will keep on playing until they are successful in the lottery, incurring transaction costs (time, money, and energy), every time they enter the lottery. If the number of the people that enter the lottery is small (the probability of winning increases), then the expected value of the lottery would increase. This would cause more people to enter the lottery. And, as above, the reverse is true. Even, though individuals have different estimates of the value they place on the permits, and different transactions costs of playing the lottery, the overall results of the lottery for the permits are similar to the simple lottery discussed above. People enter the lottery up to the point that their expected value of winning is equal to their transaction costs. All their value of visiting the bear sanctuary is dissipated in the transaction costs associated with winning their permit in the lottery. Many people end up visiting the bear sanctuary, but their $40 permit costs them far in excess of $40 when all the expense, time, and trouble of entering the lottery is taken into consideration.
It is unlikely that the lottery tickets are distributed to those who value the experience most highly. If all people who played the lottery were fully informed as to their probability of winning it is likely that fewer people would play. People play the lottery for different periods. Some play the lottery for a few rounds, estimating that their chances of winning are higher than they are in reality. After a few periods they quite playing, realizing that their transactions costs are too high. Yet, some of these individuals who play the lottery only until they acquired the information on the probability of winning, draw the permit on their first try. These people pay little above their $40 entry fee. Yet others who value the experience highly play the lottery for years, incurring very high transactions costs, and pay far in excess of their $40 fee. The permits are not allocated to those who value the experience to the greatest extent. With respect to the value that individuals place on experience the permits are distributed in a capricious manner. This entails a loss in social welfare, in that resources are not used where they are valued the highest.

C. The Economic Loss Due To NonTransferable Permits

There is one more element of the current system that needs economic clarification. That is the problem of permits that are not used and the provision for standby visitors. Currently, if an individual obtains a permit and doesn't use it (for any reason), there is a vacant slot for the period for which the permit was valid. The permit is not transferable under any conditions. These vacant slots are then allocated to individuals staying at the camp ground according to a predetermined formula (as described above), which is basically a queue. People are willing to spend substantial amounts of money in flying to the camp ground, and time waiting, potentially for several days, to be able to visit the falls viewing area. Visiting the falls under the above conditions is by no means certain, as there is no way of determining in advance what the total transaction costs (including waiting time) will be. Although virtually all of the standby visitors eventually visit the falls, a visit to the falls is not guaranteed. It is not uncommon for standby visitors to wait several days.

Additionally, there are times in which there are no standby visitors and the permits go unused. This represents a significant waste of resources, in that there are literally hundreds of individuals who applied for the permits that were denied by the lottery process. A time slot not used represents wasted resources, that are scarce by their very nature.

The fact that the permits are nontransferable creates additional waste, from the standpoint of maximizing the value of this resource for society. It is possible that permits go unused, and those that are not used by the permittee are distributed by means of a queue. The resources spent in the queue represent social waste.
IV. MARKET ALLOCATION OF PERMITS

At various times it has been suggested that permits such as these be distributed by means of the market. The general consensus among non-economists for not wanting to distribute by means of the market is based on the issue of fairness. It is argued that using the market as a means to distribute wildlife resources the rich will be the only individuals able to afford the wildlife resources. It is perceived that the average citizen will be precluded from the enjoyment of resources that are "owned in common."

It would be instructive to examine the economic implications of allocating permits via some type of market mechanism. The allocation of permits would be different, and the question that needs to be asked is whether the market distribution of permits achieve a better utilization of this scarce resource than the current method.

There is precedence for using the market as a mechanism to distribute permits. The states of Arizona, Wyoming, Montana, and North Dakota (among others) allow a small number of hunting permits to be distributed using some type of a market mechanism. A few permits are raffled or auctioned, with the funds being earmarked directly for game management or some type of charitable wildlife conservation organization that is generally involved with the management of the specie auctioned. Arizona derives approximately $34,000 per year by auctions and raffles. Montana auctioned off a bighorn sheep permit in 1986 and received $79,000. North Dakota allocates one (of seven permits total) bighorn sheep permit to be auctioned at the convention of the Foundation of North American Wild Sheep, and received $17,000 at the first auction. Wyoming has a mechanism in place whereby the governor can grant a charitable organization a permit which can be auctioned off to raise funds. The primary rationale for using the market mechanism is for the generation of revenue---"a proven method to raise funds for wildlife management."

Currently the Alaska Department of Fish and Game budgeted approximately $25,000 annually in expenses on the McNeil River Bear Sanctuary viewing program. ADF&G's annual revenue is from between $8000 an $16000 from lottery application fees (depending on the number of applicants) and another $5600 from the permit recipients (the $40 permit fee). That makes the viewing program a net cost to the citizens of the State, a transfer of between $11,000 and $2000 on an annual basis (depending on the number of lottery applicants) to the users of the program. It is more than likely that the annual deficit will be in the $10,000 range, as the number of applications in 1987 came after two programs on national television that simulated demand in the short run.

Raising revenue to cover the cost of the program is certainly one consideration when looking at alternatives to the existing allocation scheme. Additionally, given the long run State budget outlook, using a revenue system that more closely approximates user fees may be desirable. User fees, in general, have become much more acceptable. Also, economic theory suggests that income sources that are closely tied to individuals on whose behalf the expenditures are made more likely to allocate resources to their highest and best use.
One last argument in favor of using market prices to distribute the permits is the recognition that the bear sanctuary is a valuable resource for the State. It is difficult to arbitrarily decide which resources are sold on the market and which are allocated to users free of charge (especially considering that it is not free, but the value is dissipated in the distribution process). The State does not give mineral and forest resources away, and it is difficult to make a compelling case to freely distribute other types of resources. In this context the permits for use of the McNeil River State Game Sanctuary are not inherently different than other scarce resources that the State controls. It is difficult to make a prima facie case for distributing one resource free (a nominal charge, far below market) and selling another at the price the market will bear. It may be in the interest of taxpayers, in their role as resource owners, to market these scarce resource so as to maximize the return.
V. DEMAND AND REVENUE CAPTURE FOR VISITOR PERMITS

The question arises as to the amount of revenue that could be expected to be raised if permits were somehow sold at the market price (presumably using an auction type mechanism). In 1986 all individuals who participated in the lottery (both lottery winners and losers) and visitors to the sanctuary were surveyed and asked a number of questions concerning their perceptions about the sanctuary, the costs undertaken to visit the sanctuary, and their impressions of how the permits are allocated. In the year of the survey there were 806 applicants for the permits. The survey was conducted in two parts. First, the visitors to the sanctuary were surveyed and all of the non-winning applicants were surveyed. In total 488 questionnaires were collected, with 116 coming from the actual sanctuary visitors and 372 from mail surveys (unsuccessful lottery applicants). At least 20 of the visitor's surveys were from standby visitors, who were not part of the pool of lottery applicants.

Visitors to the sanctuary face substantial out-of-pocket expenditures (in addition to the time involved during the visit). There are travel and lodging expenses incurred to get to Homer, Alaska. Secondly, there are air taxi fees incurred to be travel to the sanctuary---these are sold on a seat basis and amount to $325 each. In the survey respondents were asked how they would react if various expense categories were higher. For example; "would you have applied for a permit if the fee for the air taxi were $425 rather than $325". A "yes" answer to the above question was interpreted to imply that if the permits cost $100 more in out of pocket costs the applicant would have been willing to pay that amount, in addition to the explicit costs associated with the permit. Thus, this would locate one point on an individuals demand curve for the permits. Questions concerning these thresholds were asked for $50 increments from $50 up to $200 thus giving data on the demand for permits.

Secondly, all those surveyed were asked a question similar to questions asked about contingent evaluation. Each was asked as to the maximum price that one would pay for the right to obtain a permit without going through a lottery. This data was used to calculate a second demand equation for the permits.

The demand for the permits based on threshold cost data suggests a demand for permits:

\[ P = 390.52 + (-0.59103) \times Q \]

which would suggest that if the permits were sold on a bid type basis $43,089 in revenue would be generated. The market clearing price, assuming that no price discrimination occurred, is $307.

An interesting note with respect to this demand curve, respondents were more willing to pay increases in costs if these increases arise in the private sector. Two of the threshold questions asked responses when faced with increased transportation costs. In the other two threshold questions the increase in costs occurred in the public sector; for example, respondents were asked how they would react to an increase in the price of camping fees at the sanctuary. There was a
discernable positive shift in willingness to increase private sector costs. This may reflect an anti-tax bias and a failure to recognize the value of goods and services produced or distributed by the public sector.

Using the data in the maximum bid question suggests a demand for the permits:

\[ P = 431.03 + (-.59272) \times Q \]

which would suggest that if permits were distributed through some type of market mechanism the revenue generated by the resource managers would be $48,726. The market clearing price would be $348.

Using the survey data to construct a demand curve indicates that if the permits were in someway auctioned or sold at what the market would bear the price would be well above $200, and could possibly be significantly above $300. This is an extrapolation using the data from the survey and assuming that all the applicants for the lottery 1985 were similar to those surveyed. If the $200 price were realized the revenue garnered by the state would be $28,000. If the market cleared at $300 the revenue would over $40,000, and this could possibly be much higher depending on the specific auction technique utilized.

The price at which the market would clear and the revenue that would be collected if the permits were distributed by some type of market mechanism is not clear, though the revenue collected would probably be in excess of that needed to finance the costs of facilitating the visitor program at the sanctuary. First, the amount is uncertain because the data collected in the surveys only provides a few points on the demand curve. The demand curve rests on the assumption that all of the lottery participants are similar to those surveyed. Secondly, there is no reason to believe that the demand relationship is linear. Thirdly, the actual method by which the permits are sold will impact the prices and revenue---a wide variety of market mechanisms might possibly work. Fourthly, there may be an aversion by the public to the utilization of the price mechanism to distribute the permits, as described above. Fifthly, it is likely that the prices for permits in different visitor periods might possibly vary because more bears visit the viewing area during the middle of the summer. Additionally, there are other variables, like the length of stay at the sanctuary that could be changed. If the market mechanism were used to distribute the permits the resource managers may find it to their advantage to promote the demand for the permits over time.

A. Misallocation Loss Attributable to the Lottery Mechanism

Using the two demand equations generated above (the threshold demand curve and the maximum bid demand curve) it is possible to suggest the loss attributable to misallocating the permits by the lottery. The lottery system allocates the permits at random, rather than allocating to individuals based on how they value the permits. By allocating permits at random, rather than the allocating based on value involves a loss because the resources are not used where they have the highest
value. This difference in value is a loss to society. It is taking a valuable resource and using it in a way that society values little.

For the demand equation based upon the threshold questions the average value that all the lottery participants place upon the permits is $215, whereas the price that would clear the market is $348. The lottery would distribute permits at random for a mean value of $215, for a total value of $30,100. If the market were used as a distribution mechanism the clearing price would be $348, and the total value that all the recipients would place on their permits would be $54,530. The loss in value as a result of awarding permits randomly is $24,430. Roughly 45 percent of the total value of the resource is lost as a result of distributing the permits randomly, as opposed to distributing them to people who value them the highest.

For the demand equation based upon the maximum bid response in the survey the average value that all the lottery participants place upon the permits is $195: the lottery would distribute permits at this mean value for a total value for all lottery participants of $27,300. If the market were used as a distribution mechanism the market clearing price would $307, for a total value (including consumer surplus) of $48,790. The difference of $21,490 between the two is the efficiency loss associated with the lottery method of distribution. Virtually 44 percent of the value of the permits is lost as a result of distributing the permits randomly, as opposed to using them where they are valued most highly.

This misallocation could be diminished and captured by the resource managers if a method of distribution were used that were more market-like in nature. This does not necessitate the typical auction. There are a number of alternatives available and these are explored and discussed in the next section. Currently, the lottery mechanism causes a significant waste of resources that society values highly; these resources are being squandered. More efficient alternatives are available.

B. Dissipation Loss Attributable to the Lottery Mechanism.

It is very likely that there is significant dissipation of the value of the permits as a result of the lottery mechanism. Based on the maximum bid demand equation, the total value of the permits distributed to lottery participants is $27,300, yet the Alaska Department of Fish & Game collected only $13,660. The difference between these two figures is indicative of the dissipation loss attributable to the lottery mechanism. This dissipation comes from individuals spending scarce resources in the lottery transaction---individuals spend time and resources on the lottery procedure. Individuals postpone plans because of the uncertainty associated with the lottery, and other individuals spend time and resources in the queue at the sanctuary campground. In order to actually quantify the dissipation an estimate of the value of time to lottery participants would need to be made, as well as other resources spent on the lottery. This was beyond the scope of the 1986 survey. However, it is possible to infer the magnitude of the dissipation loss.
VI. POLICY RECOMMENDATIONS

There are several different alternatives that could be used to increase revenues derived by ADF&G from the permits. At the same time these alternatives would tend to reduce the loss of social welfare that result from the misallocation of resources and would serve to reduce the dissipation of resources spent by people trying to acquire the permits.

The primary recommendation is to use a process of allocating permits that more closely approximates a market. There are a number of methods, by which this could be accomplished. Some of the more obvious methods will be discussed below, with attention paid to the problems and questions that might be encountered with using each. There are not necessarily a set number of methods to be considered, but possibly a combining of several methods, or slight modifications of a number of methods that might be considered or examined. The more options that policy makers have available the more likely a politically saleable option may be recognized. The selection of a new allocation mechanism should resolve a number of complaints with the current mechanism and achieve a larger degree of consensus among all affected parties.

A. Pure Market Mechanism

One method that should be considered is some sort of an auction or sealed bid system. Every user would submit a bid for a particular permit (specified period). Permits would be allocated to the top ten bids for each specified period.

Under this system it would still be possible for ADF&G to hold back a set number of permits that they could allocate according to some other specified criteria (scientific research and etc.).

Several questions would need to be settled before this mechanism were utilized. First, it should be recognized that, as previously stated, there is a difference between permits in different periods. There are fewer bears at the beginning and at the end of the season, so those periods would probably draw lower bids than the periods during the middle of the season when more bears are present. Just like tickets at football games, those on the 50 yard line are more valuable than those in the end zone.

Secondly, would all persons who received permits for a specific period pay the same price? All winning permit bids could be accepted, or all could pay the minimum winning bid. If the top ten bids were accepted the revenue accruing to the resource managers would be maximized. This would allow, in the jargon of economists, the most consumer surplus to be captured by the resource managers. However, problems might possibly arise because visitors during the same period could be paying significantly different prices for permits. This could lead to some visitors being dissatisfied with the bidding process, though it is not clear as to how important this would be. It may create difficulties for those who actually
deal with the visitors at the refuge. However, if all bidders recognize that they will pay their submitted bid, they would most certainly recognize that all visitors would not necessarily have the same bid price.

A related question is would it be in the interest of the resource managers to publish the minimum winning bid received during the previous year? Certainly, this information will available to some extent, but it could be provided explicitly to all bidders in the next round. If information on the previous minimum winning bid was available, presumably the differences between winning bids would be relatively small, an individual who may be willing to pay a significantly high price would be able to reduce their bid to a minimum winning level, rather than bid their true maximum value.

Thirdly, if a bidding process were used, there is the question as to whether or not to allow the permits to be transferable. If transferability were allowed permits could be sold on a secondary market, after the initial recipients received them. Allowing permits to be freely transferred would maximize the revenue for the resource managers. People would be willing to make higher bids if the permits could be resold in the event the permit owner chose not to use them (for any reason). Bidding for the permits in an open competitive process would insure that prices within the secondary market would be similar to the initial prices that were received by the resource managers. The primary political objection is that individuals would be able to make a profit at the expense of the public. However if everyone could bid on the permits when they were first allocated the price would be driven up to the price that would be paid by the ultimate permit users. Profit margins would be driven to zero with competitive bidding. If permits were not freely transferrable the bids would be lower because the purchase of a permit that can only be used by a specific individual entails some risk (a conflict could arise). The lower bids would reduce the total revenue derived by the resource managers.

If permits were not allowed to be transferred freely then some sort of redemption process would need to be adopted. There could be some time period whereby the initial purchaser could redeem a portion of the purchase price. The permit could then be allocated to persons in some sort of a queue, based upon some other allocation scheme. This could be done on the basis of bids, lottery, etc. However, it needs to be recognized that this would require an additional administrative process, which uses scarce resources; and the initial bids would probably be lower.

B. Current Lottery with Elevated Fee Structure

At the minimum the fee collected from the current lottery winners could be raised. From the standpoint of user fees, the available information on demand suggests that the program can be self-supporting. Currently, the general taxpayers are subsidizing the users of the program. The total costs of administering and maintaining the program are less than the total revenues collected. The general taxpayers are subsidizing the users of the program. Additionally, the survey data suggest that the program users are in the upper levels of the socio-economic strata. Users are certainly not in the lower income levels, as their mean income levels in the survey was in excess of $50,000 and the median income level was $32,000. Only 6 percent of those surveyed were in the lowest income category (less than $15,000).
In raising the fees the objectives need to be clearly defined. The fees could be set at the level that would provide the resource managers with enough income to cover the expenses of administering and maintaining the permits and visitors. The total cost divided by the number of permits would determine the permit price, and then there would still be a lottery application fee. The decision as to which costs the resource manager would include in the calculation presumably could be easily answered.

However, if the fee structure were set at this level the problems that plague the current program of misallocation and resource dissipation would still be present, but to a somewhat lesser degree. Permit prices would be somewhat higher, but the number of lottery applicants would still be substantially in excess of the number of available permits.

Alternatively, the permit prices could be raised to the point that the number of persons seeking permits is near the number of permits available. If those seeking permits exceeded the number of permits available (a shortage), the price of the permits could be increased. If the number seeking permits were smaller than the number of permits available (a surplus) the price of permits could be reduced. This alternative would approach the above bidding scheme (especially in terms of revenue), except that the price of the permit would be identical for all persons. A problem with this alternative is that it would be done with a year lag. As the market clearing price would not be known in advance each year, raising or lowering the price in response to a shortage or a surplus could only be done in response to what happened the previous period. Demand for the permits is different every year, and this alternative allocation scheme is not very sensitive to these changes. Not being able to gage demand every year will produce either surpluses or shortages, each with their attendant problems. With a surplus of permits valuable resources go unused (otherwise an alternative mechanism is needed to allocate the unused permits), and with a shortage all the problems of misallocation and dissipation are present.

C. Mixed System: Market and Lottery

Using a bid type system to distribute permits may be very unpopular politically. The potential user group is relatively small and narrowly defined. They stand to gain substantial benefits if the permits are distributed freely and the program is subsidized by the state (taxpayers, in terms of foregone opportunity cost of the resources used elsewhere). The taxpayers, on the other hand, will have little incentive to push for raising the costs to this user group because each taxpayer has little to gain from the users paying the costs of the program. Thus, the political calculus may dictate that some consideration be given to user groups.

One alternative may be to allow half (or some other portion) of the permits to be allocated by means of market prices, and the other portion allocated by means of some type of lottery, with appropriate fees. Users would choose which allocation scheme they would use to apply for permits. Alternatively, users could apply for the lottery permits, and then bid on the permits that are allocated by the means of market prices.
Another variation would distribute a portion of the permits by means of a lottery that is reserved for Alaskan residents only (assuming this would withstand Constitutional scrutiny), and the remainder could be allocated by means of market prices. Alaskan residents could be given the option to participate in the market price portion of the program if they chose to do so.

One last option is suggested in response to the criticism that the market method of distribution leads to the permits going to the wealthy. Based upon an incomes test, low income bidders could be given a credit in the bid process. This credit could be based on a sliding scale of income as documented by a copy of the income tax return. For example, allow bidding to determine the allocation of the permits, and someone with an income of $20,000 would qualify that person for a credit of $100, and a person with an income of $15,000 would receive a credit of $150 to use in the bidding process. If they had one of the winning bids, the bid price would be reduced by the amount of the credit. It may be desirable to stipulate that a person could use such a credit in the bid system only once. This credit could be limited to Alaskan residents, forcing all non-residents to pay full price as determined by the bids. People who have used credits could be listed by social security number, which would make monitoring relatively easy.
VII. CONCLUSION

The current lottery mechanism involves substantial efficiency and dissipation losses, which mirror lost revenues by the resource managers. The resource managers could capture these revenues by instituting a permit distribution mechanism that is more market-like in nature. There are several other reasons for such a policy, in addition to reducing resource waste. Taxpayer subsidization of essentially private activities is one of the bases for making the distribution mechanism more market-like. Moreover, the resource managers and the state may want to enhance their revenues beyond defraying the costs of managing the sanctuary. A pure market mechanism is not necessary, as it would be possible to allow certain preferences. At the very minimum, though, the price of the permits could be raised to cover the entire costs of managing the sanctuary. The demand for the permits is certainly strong enough to support such a change.

Certainly, the frustration experienced by many of the lottery participants will continue, as there is currently no mechanism for anyone with extremely strong preferences to register those preferences. On average lottery participants can expect to wait for up to 10 years before obtaining a permit.

The National Geographic Society is expected to do a feature on the walrus sanctuary at Round Island in the summer of 1990. Thus, this wildlife viewing area will have international exposure. The resulting demand for visitor permits could be so great that allocation decisions will need to be made. An economically and fiscally efficient visitor allocation mechanism should be high on the agenda.
REFERENCES


