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Vegas Winners

by John Trijonis

When I was asked recently by the Caltech Alumni Association to describe my life as a Las Vegas gambler, the thought struck me that very few people even know that my world exists. Of course, everyone is aware of the immense casino gambling industry in Nevada, but I assume that most people realize that the percentages are set against the players. They didn't build all of those exotic hotels and gilded casinos by letting the players have the edge. Nevertheless, throughout its past 50 years of spectacular growth, Las Vegas has always accommodated an anonymous but thriving culture of successful gamblers ("winners" in the local vernacular).

In describing this culture and my niche within it, I will focus on the following questions: Where in the casinos can you legitimately win? How is my specialty, sports betting, set up? What techniques did I use to derive a successful system? Why is the gambling culture so shadowy and obscure? How did gambling relate to my education and scientific career? Would I recommend this way of life to others?

WAYS TO WIN

Figure 1 portrays a history of the ways to win in casinos over the last half century. The seven curves in the figure represent, in a very approximate fashion, the average yearly winnings for a top-level gambler in seven different areas where the casinos were getting legally beat. Before addressing these areas individually, however, it is useful to understand the assumptions and ground rules for the figure.

First, the curves are really only "guesstimates," qualitatively in the right ballpark but certainly not quantitatively precise. I arrived at them through discussions with various gamblers who I thought were most in the know. The single tick on the left-hand axis should be somewhere around $1 million per year. In order not to understate the
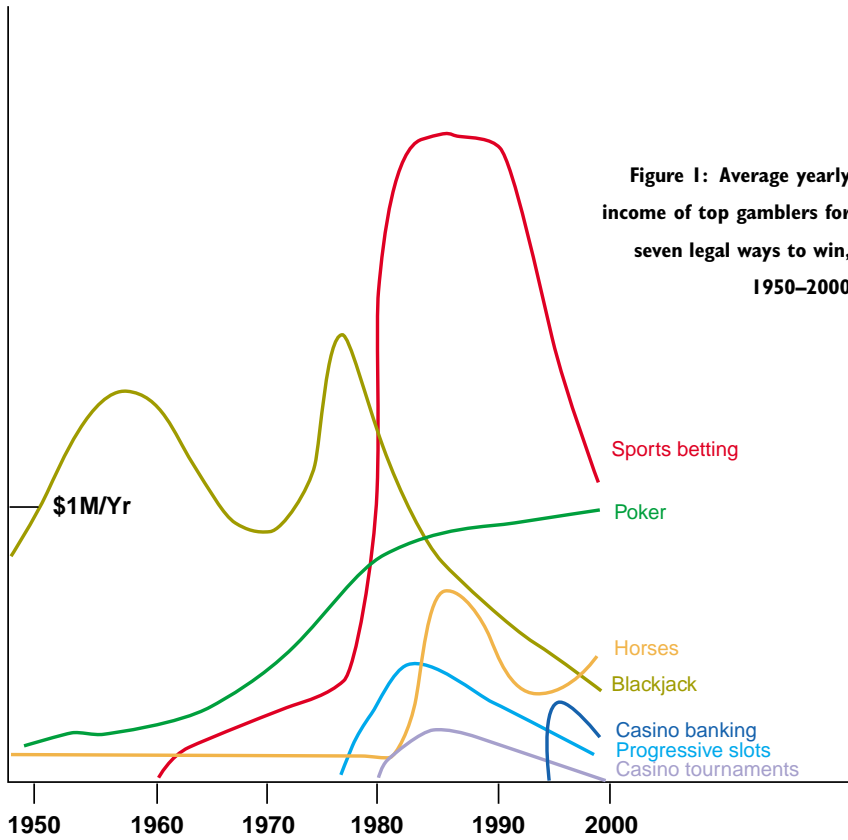
great blackjack boom of the 1950s and '60s, I have attempted to represent the winnings in constant dollars (based, say, on the year 2000).

Second, the curves represent earns for the highest level of gamblers, the most successful top few (three to five). In some of the games, most notably blackjack and poker, there were scores of other gamblers winning at a 10th or 20th the rate of the uppermost few.

Third, it is important to stress the qualifier "legal." There have been many schemes and machinations for attacking the casinos illegally: marking cards, having adroitly placed spies peek at cards (for example, the dealer's hole card in blackjack), mechanically fixing dice or slot machines, cooperating with a cheating dealer who is your partner, tossing dice illegally (that is, throwing them short with a special spin just one time when the thrower or his accomplice places a very large bet), or employing hidden computers (for example, to calculate the physics of roulette). I assume, however, that the reader shares my great antipathy for the possibility of prison (or, in the old days, the possibility of the casinos' own brand of punishment).

Finally, at the risk of stating the obvious, when listing ways to win, I am referring to ways of gaining a positive mathematical percentage. Contrary to the advice of the gambling books sold at the Las Vegas airport, you cannot win in the long run with a negative percentage through any sort of bet-timing or money-management scheme. Basically, the winners find a way to be like the casino; they gain a small advantage and play it as often as possible. They remind you of Bill Gates, not Frank Sinatra.

Addressing the games per se, the original way to make a windfall at the casinos was blackjack in the 1950s and early 1960s (first popularized in the book *Beat the Dealer* by Edward Thorp). Using computer-optimized strategies for card counting, bet timing, and card playing, the top players had a

Figure 1: Average yearly income of top gamblers for seven legal ways to win, 1950–2000

$1M/Yr

Sports betting

Poker

Horses

Blackjack

Casino banking
Progressive slots
Casino tournaments

1950   1960   1970   1980   1990   2000

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field day up to the early 1960s. At that time, the casinos found tactics to beat back most of the onslaught, specifically by introducing multiple-deck games, restricting play options (that is, changing rules), evicting or harassing suspected card counters, and (allegedly, in the early days) employing cheater dealers. Atlantic City opened in 1978 with a "hand-surrender-option" rule, with a player advantage misunderstood by the casinos, that once again allowed a romp for the best players. When this was corrected by the casinos, and their aforementioned tactics were refined, blackjack became a very "tough beat." In fact, the plus percentages are now so low that an expected income of $100,000 per year requires extremely long hours of play at stakes that risk financial swings of several hundred thousand dollars.

Poker is the other game that has provided solid earnings for winning gamblers for most of the last half century. In this case, the winners are actually beating other players, not the casinos, with the house just charging rent for the table, dealer, and accommodations. Wins have increased over time because of two factors: (1) the casinos have become more diligent about keeping the games honest, and (2) some very rich, very romantic amateurs have been lured by the challenge of tackling the world's best players. The top players owe their edge to familiarity with the scientific poker literature, meticulous notes on opponents, personally funded computer simulations, and many thousands of hours of experience.

Despite the excessive house "take," approaching 20 percent, horse betting has always been profitable for a few astute scientific handicappers (odds-analysts). Historically, however, wins have been severely limited by the amount one could viably bet. Betting large amounts in the "floating odds" pari-mutuel system of horse racing is financially suicidal because the payoff odds are decreased by one's own bet. Also, years ago, when casino race-

books were not tied directly to the racetrack pari-mutuel pools, casinos tightly limited accepted bet sizes. A trickle for horse players briefly became a flood in the 1980s, when racetracks introduced progressive jackpots, such as Pick-6 pools, in which a bettor must pick the winners of six races or else most of the pool carries over to the next day. (When large Pick-6 pools accumulated, even uneducated random bets would yield positive expectations. This promoted very large bets, in the $10,000s to $100,000s, spread over thousands of horse combinations). Competition among bettors drove earnings down until the mid-1990s, when Nevada casinos, buoyed by the large overall take on horses, offered rebates to horse players to

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partially cover losing bets (which, of course, greatly helped the few winners).

The introduction of progressive jackpots is also the reason that slot machines have been a viable earn since the early 1980s. Winning slot players, often in teams, descend on a group (carousel) of slots when the jackpot becomes large enough to yield a positive expectation. Play typically continues nonstop until the jackpot is hit, with players relinquishing their seats only to partners. If the slot is a game of video poker, the players adopt mathematically optimized card-choice strategies to minimize losses until the jackpot is won. Competition among professional slot players, who vie with each other to catch winning situations at smaller and smaller plus expectations, has driven earnings down in the 1990s.

Casino tournaments, another innovation of the 1980s, allow players to win at games that are otherwise unbeatable, such as craps, roulette, and nonprogressive slots. In tournaments, players pay entry fees that are partly returned as prizes to the most successful entrants. The advantage of the prize money allows the best players to overcome the underlying disadvantage of the game. The winners place their wagers on the play options with minimum disadvantage and employ mathematical game-theory tactics to optimize their chances of emerging as the victor. Profits from casino tournaments, never very large, dwindled in the 1990s because of competition among gamblers and because of waning popularity.

A new opportunity has arisen in the 1990s at casinos outside Nevada—for example, at California card parlors and at Indian reservation casinos. For some games (such as blackjack and Pai-gow poker) in certain casinos, the house is able to charge table usage fees to players but is not legally permitted to book the game. Rather, the dealer or "banker" for the game must be another player. Taking the banker role in such situations can yield a great mathematical edge to the professional gambler. One big problem with banking is that, unlike the situation with its own games, the casino host has little incentive to prevent cheating against a private banker, so that fraud and chicanery have severely pared (and in many cases eliminated) profits.

The biggest wave of player winnings ever to hit Nevada came from sports betting, which was fantastically profitable up to the middle 1990s. Since then, it has been driven back by improved casino odds-making, by reduced casino betting limits, by new regulations restricting organized betting, by real-time publication of casino odds (which allows casino managers to make better adjustments), by consolidation of casino sports books (placing a bet at any of a group of aligned books instantaneously eliminates opportunities at the others), and by intense competition among bettors. This sports wave was set off in the early 1980s when a few high-rolling gamblers (mostly top poker players) discovered three or four analysts performing scientific sports handicapping. As detailed in my story below, I was immersed in the wave as one of the latter.

SPORTS BETTING

Casinos attempt to make a profit in their sports books by using an odds differential for the two sides of a sporting contest. For example, in a baseball game where the true odds on the favored team are thought to be 3:2, the sports book offers a line of 160:140, meaning that a bettor on the favorite must lay $160 to win $100, while a bettor on the underdog would be risking $100 to win only $140. In sports such as basketball or football, with a "point spread" handicap designed to even out the odds (for example, the Lakers were recently favored by 9 points over the 76ers), the bettor lays $110 to win every $100 regardless of which side he takes (the Lakers minus 9 points or the 76ers plus 9 points).

Although this level of odds differential yields a nice casino profit (nearly 5 percent) against unsophisticated or random bettors, it did not—in the past—provide an adequate cushion against scientific bettors. Using the point spread example of an 11:10 odds differential either way, a bettor has a net advantage if he can win at least 11 games for every 10 he loses (11 out of every 21 games), or just 52.4 percent. Up until the last five to ten years, casino point spreads commonly contained

substantial errors due to inaccuracies in initially calculating the spreads and inefficiencies in making adjustments as bets were received. During their heyday, the best scientific handicappers were able to use these errors to maintain winning percentages against the point spread of about 57 percent. This translated to a positive return on their bets of about 10 percent (57 percent minus 1.1 x 43 percent, the 1.1 representing the odds differential they had to pay). With an acceptable level of risk, such a handicapper could turn over his bankroll (total capital) about once every three to four weeks, so that the earnings on his bankroll would have been 10 percent every 25 days, which compounds to 300 percent (a quadrupling) per year!

Historically, two major problems confronted scientific handicappers. First, as you might surmise from the previous paragraph, the handicappers had difficulty finding places where they could bet enough money to accommodate their burgeoning bankrolls. People called "followers" exacerbated this problem. As soon as a known winner would bet on a game at one casino, the casino would change its point spread on that game significantly. Furthermore, clerks or other bettors who witnessed the wager would start a chain reaction, betting the hot game at all casinos, so that the advantageous point spread would be eliminated at all casinos within a few minutes. The second problem for the handicappers was to maintain their fundamental advantage over the casino oddsmaker (that is, their 57 percent or so win rate). The casino oddsmaker continually improved his analysis, with much of the improvement coming from ways he devised to anticipate the winner position by learning from previous winner bets. A few handicappers were able to maintain their level of advantage for more than two decades, but this was not without continual advances in their methods, and not without some major bumps in the road. There was always the threat that the casino oddsmaker or the effects of some other winner might, at any time, start making the point spread a trap instead of an opportunity.

Both problems were solved, at least up to the mid-1990s, by the aforementioned union of scientific handicappers and high-rolling gamblers. First, the high rollers promised to bet larger amounts for their scientist friends than the latter had been able to bet for themselves (although there were still limits, of course). The gamblers accomplished this by organized teams of runners and phone persons who would bet at all the casino sports books simultaneously. The gamblers also were able to negotiate high limits at many casinos through various arrangements and connections. They even concocted ways to shake the followers by making phony plays (initially betting on the wrong side). Second, the high rollers eliminated the risk by offering their scientist friends a guarantee. This guarantee, virtually never activated, was that the scientists didn't have to pay their share if the bets showed a net loss for a sports season. The gamblers—with their organization, their large initial bankrolls, their willingness to assume all the risk, and their determination to persevere through all the losing streaks—were amply rewarded. Although they bet considerable amounts for their scientist friends, it was only a fraction of what they bet for themselves. The most successful winners in sports (those represented in Figure 1) were the high-rolling gamblers, not the handicappers.

SPORTS HANDICAPPING

Handicapping analysis may not have been the most lucrative side of the sports-betting wave, but it has always been interesting and challenging. The basic objective of handicapping is to determine the best scientific estimate for the odds of a team winning a game—or in the case of a point spread, the best scientific estimate for the median final score of a game (the scientific point spread). When the casino point spread differs enough from the scientific point spread (typically by at least one and a half points or more), it is worthwhile to bet. The greater the difference is, the more the advantage and the larger the bet.

My own method for deriving a scientific point spread consists, essentially, of adding together numerical values for various factors, such as those listed in Figure 2 for basketball or football. It takes many years of experience to recognize all the relevant factors, and there is a lot of room for creativity in coming up with data and statistical

methods to quantify the factors. The values for each factor are determined using as much data as possible. For example, my own data history for pro basketball covers about 30,000 games. Data for some subjective factors (such as how much a team is typically affected by morale problems) must be collected personally, over the years, game by game.

Figure 2 can also be viewed as a chronology of sports handicapping analysis. In the 1970s, a handicapper would have done very well if he just did a reasonable approximation with the primary factors. By the early 1980s, he needed to perform an exact analysis of the primary factors, along with a rudimentary consideration of the secondary factors. By the early 1990s, a precise analysis of both primary and secondary factors was required for success. Now, even that may not suffice. Today's handicapper needs to invent some secret weapons if he is to remain successful in competition with the casino oddsmaker and other scientific bettors. By a secret weapon, I mean information that is significant yet so arcane or original that few if any competitors are aware of it. For the obvious reason that it wouldn't be secret anymore, I cannot divulge my current arsenal. However, to give the reader a better idea of the concept, I will relate some examples from the past—things that were once secret but are now well known.

One example concerns betting "totals" on professional basketball games. Totals bets are not on who will win the game, but rather on total number of points to be scored in the game (you bet that the points scored will be over or under the totals point spread). In the early 1980s, a gambler who specialized in the National Basketball Association realized that the casino oddsmaker was doing a reasonable job with the routine statistics of the NBA totals, but that there was a hidden factor dominating the total scores. This factor was the coach's game plan each day—specifically whether the coach intended to have his team run with the opponent (leading to a high score) or slow it down (leading to a low score). The gambler also had an ingenious scheme to obtain the best source for game-plan information—local newspapers. (This was long before daily newspapers became available on the Internet.) He befriended a service contractor who cleaned airplanes at the Las Vegas airport, and his friend's crew collected the local papers for every NBA city from the first flights arriving each morning.

An example from baseball concerns pitcher/hitter matchups. For nearly a century, it has been known that left-handed pitchers perform significantly better against left-handed hitters than right-handed hitters (vice versa for right-handed pitchers). Just a few years ago, however, a scientific handicapper discovered that there is another significant matchup, this one of pitchers and hitters who each have a proclivity to produce either fly balls or ground balls. When a fly-ball

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PRIMARY FACTORS
• team power ratings
• overall league home advantage
• worth of players

SECONDARY FACTORS
• travel distances and days off
• emotional influences
    – revenge against current opponent
    – effect of previous game
    – team morale
    – anticipating next opponent
• offensive/defensive matchups
• special home advantages of individual teams
• player substitution patterns
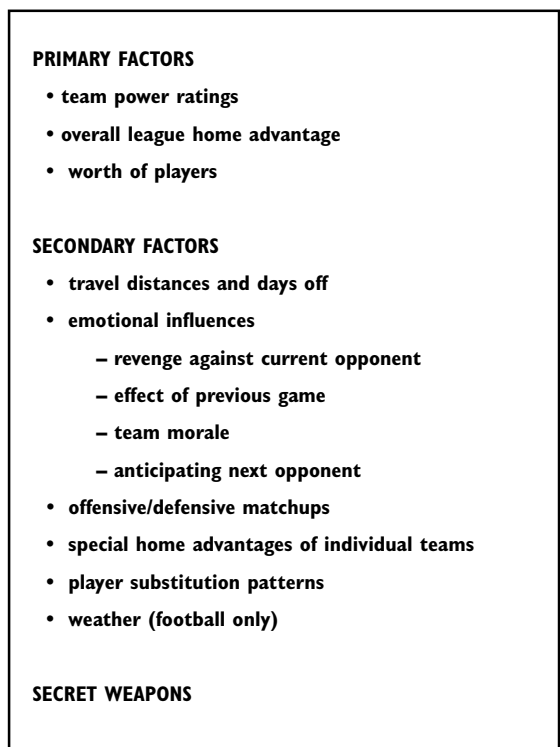• weather (football only)

SECRET WEAPONS

Figure 2: Factors in predicting outcomes of football and basketball games.

pitcher faces a team loaded with fly-ball hitters, he tends to be successful, achieving many strike-outs and pop-ups. On the other hand, when he faces a team populated with ground-ball hitters, he is apt to yield lots of line drives. With the help of this factor, the handicapper in question was able to capture the vanguard position in baseball betting.

AN UNKNOWN CULTURE

As I noted in the introduction, gamblers tend to shroud their activities. There are two major reasons, the first being fear of competition. Why let rivals know about a positive situation? This idea relates to the struggle against other gamblers and against casino managers. The importance of competition can be seen in Figure 1, where most of the curves show a sharp decline after a peak in winnings. Gambling profits have been razed over time by casino countermeasures and rivalries among winning gamblers.

Concern over competition also explains why there is little decent academic literature on gambling; the winners cannot afford to alert their

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opponents. (In 1980, Professor of Mathematics Gary Lorden wrote an excellent article for *Engineering & Science* explicating how you can maximize your chances for a windfall in casino games with the percentages against you. There is little or nothing written of comparable quality, however, on how to turn the tables on Las Vegas and get the percentages in your favor.) As to sports betting, I have come across a few articles in the scholarly literature, especially economics journals, but they have all bordered on the nonsensical—with a few far over the border. To paraphrase an old maxim: in gambling (as perhaps in stock and commodity trading), those who can, do; those who can't, publish. The reason I feel comfortable writing this essay is that the competition has already waxed in sports. Handicappers are now commonly heard commiserating with the refrain: "Boy, it's getting brutal out there."

Legal concerns make up the second reason for the furtive nature of gambling. Gambling laws tend to be both expansive and ambiguous. A leading Las Vegas attorney once told me: "With gambling, you can't walk across the street without exposing yourself to at least the possibility of some sort of selective prosecution." Another said:

"Some law-enforcement personnel view winning gamblers as akin to pornographers. In their minds, it's just not right." In the 1980s and early 1990s, I heard about several law-enforcement raids on sports betting, usually on the highest-rolling gamblers. The typical scenario seemed to be that a high roller making large amounts of money in sports was mistaken for an illegal bookmaker, that is, a sports bookie accepting bets from others. Fortunately, gamblers that I have personally known who became entangled in such investigations had all been scrupulous about following the law and paying their income taxes, so they were exonerated. Nevertheless, the potential for the unnerving reality of legal trouble is always there.

GAMBLING AND SCIENCE

Despite its louche reputation, gambling was always highly complementary with my scientific education and career. Undergraduate and graduate schooling at Caltech taught me how to structure problems sensibly, how to derive mathematical solutions, and how to cross-check results. In the Vegas vernacular, I could think straight. My Caltech curriculum never included a course in probability/statistics per se, but I learned the foundations of that subject during the first month of a hydrology course taught by Norman Brooks (now the Irvine Professor of Environmental and Civil Engineering, Emeritus). He instilled those foundations so thoroughly and so well that, in my entire scientific and gambling career, I never felt second best in being able to understand data or compute odds.

After my PhD, concurrent with my first 20 years as a gambler, I had a full-time career as an environmental scientist. My specialty was interpreting large sets of air-pollution data. The techniques I used for organizing and analyzing pollution data transferred directly to sports data. It might be of interest to note that there was even a specific data set that transferred—weather information. Because of my familiarity with the National Weather Service archives, I decided early in my gambling work to quantify the effect of weather on sporting events (a secret weapon at that time). The most significant impact was on baseball totals (bets on the number of runs scored in a game), where wind speed, wind direction, and temperature proved to be critical.

Personally, it was even more meaningful that gambling had a positive impact on my environmental-science career. In air-pollution research, there are only two significant sources of funding—governmental agencies and private industries (basically, the polluting industries). In my perception, the government agencies essentially want to determine if there is a problem and what can be done about it. The polluting industries, on the other hand, often seem in deep denial. They tend to assert that (1) there is no problem, (2) even if a

problem exists, they aren't the cause, and (3) even if they were the cause, the nature of the problem is too uncertain to try to do anything about it. Being a product of the '60s and a little quixotic, I could only bring myself to work on government studies. Unfortunately, the largest and most lucrative consulting contracts came from industry. This situation not only severely limited my income, but it meant that my research was, in my view, subject to incessant carping from industry scientists and their consultants. (It appeared to me that I was continually trying to defend a simple, reasonable $40,000 government study from red herrings raised by some multimillion-dollar industry project.) The gambling was a godsend, providing me a great income and an objective test that my way of interpreting data was truly correct. As a friend of mine said to me when I first considered putting the effort into sports betting: "Wonderful! It might provide your 'up yours' money!"

WANT TO TRY IT?

You might be wondering about trying out a gambling avocation. If we were in the early 1980s, with so many of the curves in Figure 1 on the upswing, I would enthusiastically recommend it for any good scientist. It's exhilarating to be living by your wits and a peculiar, thrilling type of fun when you and your colleagues seem to be tapping a boundless money tree. I would issue two general cautions. First, you would need to be objective in evaluating your prospects, diligent in striving for improvement, and receptive to the possibility that competitors might shift the playing field. Second, you would have to be careful about the law. This means paying all your taxes and following the advice of attorneys who are experts on gambling regulations.

In actuality we are beyond the 1990s, a decade that saw most of the winning opportunities in Las Vegas battered by competition among scientific gamblers and by countermeasures from casinos. The notable exception—and the best candidate for a career—is poker, where a high earning potential continues (although it demands an ever-increasing amount of skill). If you are willing to devote a couple of years to perusing the literature, studying computer simulations, scrutinizing players, and gaining general experience, you have a chance to become a solid winner. The major disadvantage of poker, assuming you can be successful, is the interminable time spent at odd hours in crowded, smoky rooms.

Sports betting is a very natural area for scientists familiar with data analysis. Competition is already fierce, however, among experienced mathematical handicappers entrenched with immense historical databases. So, I wouldn't recommend it. That is, unless, you concoct some omnipotent secret weapon! □

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John Trijonis
Big T, 1966

John Trijonis earned his Caltech BS in engineering and applied science in 1966, his MS in aeronautics in 1967, and his PhD in environmental engineering science in 1972 with the thesis "An Economic Air Pollution Control Model—Application: Photochemical Smog in Los Angeles County in 1975." During his "first life," as an environmental scientist, he was president of the Santa Fe Research Corporation from 1979 to 1993, where, as he says in his article, he "could only bring myself to work on government studies." His main areas of concentration were aerosols and atmospheric visibility, and he published papers on such subjects as "Patterns and Trends in Data for Atmospheric Sulfates and Visibility" (1986) and "Protecting Visibility in National Parks and Wilderness Areas" (1993). For more than 20 years, he pursued a concurrent gambling avocation. As he states in the article, the financial independence provided by gambling had a very positive effect on his environmental science career.