



I have been flying captive-bred Harris's hawks since 1982, when Tom Coulson and I started producing them in reasonable numbers. Over the intervening 28 seasons I have flown 31 different captive-bred Harris's hawks, from coast to coast and border to border in the U.S.

In my first few seasons I was able to fly my Harris's hawks every day by playing hooky from graduate school. As might be expected, the hawks responded well to the daily flying and became very accomplished on swamp rabbits. I maintained strict weight control on my hawks for two reasons. First, careful weight control is how I was taught to train and fly hawks. Second, I was hawking in tightly enclosed fields bordered by busy roads and neighborhoods where a wide-ranging, minimally-controlled Harris's hawk might get into serious trouble. In an emergency, I needed to be able to recall the hawk from the top of a tree or building where she had taken stand. Third, the warm, humid climate in south Louisiana also contributed to the need for weight control. Hawks just don't feel as hungry when it's warm.

After grad school I moved to Seattle, and for the next 20 years or so I was more or less a weekend Harris's hawk. Of course, there were some longer stretches of flying, a week or two at a time when the summer days were long, or over the winter holidays. In an average season I was able to hunt on about 90 days between early August and mid-January, catching 100-200 rabbits every year. I rarely flew my hawks past mid-January because I don't like to catch pregnant rabbits. Most of my hawking was in industrial areas for eastern cottontails, with frequent forays into the Columbia Basin of eastern Washington in search of black-tailed jackrabbits and mountain (Nuttall's) cottontails. Again, because of my episodic hawking schedule and with my usual hunting grounds confined by fences, electrical transformers, and other hazards, I found that my Harris's hawks needed to be flown within a fairly narrow weight range ($\pm 10g$ or so) to be at their best consistently.

With a cast of Harris's hawks and a brace of Jack Russell-beagle crosses I had 20 years of great rabbit hawking. I wouldn't trade that time for anything.

But five years ago I began to spend 7-8 uninterrupted weeks every summer, from mid-July until late September (before university classes start) in sagebrush country, hawking jackrabbits and cottontails in Oregon and Wyoming. The daily routine of hard pursuit flying, ample high quality food consumed during every hunt, the cold nights and cool mornings, and the unbroken remote expanse of the sagebrush ocean allow me to hunt my selectively-bred Harris's hawks with minimal need for control. The Harris's hawks respond by reaching a state I call "transcendence" – weight control becomes practically irrelevant as the hawks settle into a daily rhythm of maximum-effort pursuit rewarded with full crops of warm jackrabbit in the morning, followed by weathering and bathing in the afternoon, and a good night's sleep to prepare for the next day's adventure.

The hawks wake up hungry for action more than hungry for food. Habit is more important than weight. The hawk's desire to chase and kill is largely uncoupled from her desire to eat. The best jack hawks will "go weasel" – relentlessly killing rabbits one after another almost regardless of how much food they have in their crop.

Transcendent hawks fly with incredible style and drive. A cast of female Harris's hawks scours the sagebrush, rabbitbrush, and greasewood flats like Destroying Angels. The typical jackrabbit flight begins with a long slip (50-100 yards), and requires the hawks to do a lot of accelerating, turning, stooping, and rebounding. As a consequence of this exertion, the hawks become extremely fit, and are able to develop novel, sophisticated attack strategies that depend on strength, endurance, and hard-won experience. Flying in a stiff breeze, each hawk in the cast may take off in a different direction, with neither flying directly at the jack, making use of the terrain and wind to

put a pincer move on the jackrabbit. The jackrabbit does not even know it is being chased until the hawks have set it up for the kill! It is common for a successful flight to end 300-400 yards from where it began. The first hawk to make contact may have to ride the bucking jackrabbit until her castmate powers in at full steam to secure the jack's head. I often arrive on the scene to find one or both hawks jammed into the sagebrush, feathers and fur scattered about the site of the kill, a testament to the courage and persistence of victor and vanquished alike.

Every missed stoop is followed with a rebounding, wing-whipping attack. When the jackrabbit stops or turns, the hawks pitch up very high and make a hammerhead turn at the apex, stroking all the way back down. The thundering crash of the ultimate collision with the jackrabbit can be heard for 100 yards or more. Many of the jacks are eviscerated or killed on impact. And the hawks can maintain this intensity for hours on end, day after day, week after week. It is pure magic.

Harris's hawks are born to this kind of flying. Being cooperative hunters, they chase and kill to provision their packmates, not just (or even mainly) to feed themselves. Their social bond with the falconer is strong, and a properly-bred Harris's hawk doesn't need to have its weight controlled in order to remain tame, nor to follow the falconer and packmate(s) in the field. Flying Harris's hawks in the transcendent state is as close as a human can come to sharing the hunting fields with a family of wild Harris's hawks.

Transcendent hawking in the Great Basin has ruined me for weekend hawking – there's no going back.

Transcendent metabolism explained

I take an intermewed Harris's hawk out of her molting chamber 7-14 days before the start of the hunting season. I feed her a daily ration of 10-20g of washed meat (cottontail if available; jackrabbit otherwise) dusted with Vitahawk. I don't like to fast my hawks – they get something to eat every day. It takes energy to digest food, and a hawk will lose more weight when eating low-calorie, bulky food (*e.g.*, lean washed meat) than when fasting. In addition, washed meat keeps the hawk well hydrated, provides some protein to start building flight muscle as she begins to exercise, and keeps her digestive system in good working order, improving her appetite. A few days into this regimen, the hawk will be losing a steady 10-20g a day. In other words, she could maintain her weight (*i.e.*, not lose a single gram in 24hr) on just 20-40g of washed meat per day.

The fascinating thing is that this same hawk, reaching transcendence about 3 weeks into the hunting season, being flown hard 2-3 hours a day, will require 90-100g of warm, rich jackrabbit flesh every day in order to maintain her weight. Furthermore, she will be flying at a body weight *ca.* 100g higher than when the season started, usually very close to (or even above) her molting weight. How is it that a “transcendent” Harris’s hawk can eat a full crop of jackrabbit without gaining weight – consuming three to five times the number of calories that were necessary to maintain her weight just a few weeks before?

Obviously, some of the extra calories are burned in strenuous flying. The hawk flies miles every day in full power pursuit of jackrabbits, taking very long slips and making hard-turning, multiple reflush, rebounding flights with a lot of spectacular vertical moves that test her endurance.

But the majority of the extra food requirement does not come directly from the energy expended in flying, but rather from the constant high metabolic demand of the flight muscles when the hawk is at rest. A transcendent hawk has a high basal metabolic rate as a consequence of sustained high-intensity exercise.

A hawk coming out of the molt, sedentary and fed *ad libitum* for months, has relatively little muscle mass and considerable fat. Since adipose (fat) tissue has only about one-third the metabolic rate of an equivalent mass of muscle tissue, the freshly-molted hawk has a low resting metabolic rate, and can maintain her weight on a small amount of food.

The hawk’s molting weight is misleading, because it doesn’t account for her body composition (low in muscle, high in fat). **The goal of post-molt conditioning/dieting is to increase the hawk’s muscle mass and reduce her body fat.** Body fat must be reduced to increase the hawk’s appetite, and flight muscle mass must be increased to give the hawk speed and stamina. The hawk’s weight is a very crude (poor, in fact) measure of this change. Her weight is easy to determine accurately, but the more useful metric – her body composition – is not.

A falconer who is fixated on a single “ideal weight” for the hawk is missing the point. The hawk’s optimum flying weight varies with (among other things) the hawk’s body composition, age, amount and intensity of flying, air temperature, and the degree of control required by the hawking conditions. For example, my ace jackrabbit hawk, Shadow, with more than 400 jack kills (and two seasons of over 100 jacks each), made her first kill in her inaugural season at 823g. Yet as an adult, flying in the “transcendence zone,” Shadow has caught jackrabbits at weights of up to 1111g – a

increase of 288g (35%) from her first kill! The six female Harris’s hawks I’ve flown in the “transcendence zone” flew an average of 25% (203g) heavier than the weight at which they made their first kill (Table 1). It’s not that weight control is obsolete, but a triple-beam balance is no substitute for a skillful falconer’s powers of observation and application of knowledge gained through experience. Maximizing the hawk’s hunting performance is the goal of falconry, and weight control is a blunt (but useful) instrument to be used in attaining that goal.

Table 1. Weight increases from first kill to transcendence.

Hawk’s name	Weight (g) at first kill	Weight (g) at transcendence	Weight increase (%)
Q	787	1010	28%
Shadow	823	1111	35%
Louise	894	1025	15%
Una	913	1083	19%
Vici	791	1040	32%
Whiskey	832	983	18%

So, how do we bring a Harris’s hawk into hunting condition after the molt? Unfortunately, as any dieter knows, reducing food intake does not lead to a commensurate reduction in body fat. When a vertebrate animal perceives starvation conditions, such as when a hawk is put on short commons, *muscle mass is cannibalized as a high-priority source of energy, while adipose tissue is only metabolized as a last resort*. This preferential depletion of muscle tissue makes good evolutionary and biochemical sense. Muscle is three times as metabolically active as adipose tissue, so a starving animal can prolong its life by giving up the energy-demanding muscle tissue first. This “starvation metabolism” – using muscle before fat – is why dieting alone cannot produce the desired body composition of a fit hunting hawk (high in muscle, low in fat).

“Starvation metabolism” causes problems for the falconer. Since biochemistry dictates that fats cannot be converted directly into protein (of which muscles are made), the hawk must be fed protein in order to build new flight muscle tissue. But any protein that is fed to the hawk will be used first as a source of energy to prevent body fat from being metabolized, and only when these energy needs are met will the protein in the hawk’s food be used for muscle growth.

There is a one-word solution to this dilemma: exercise. The most effective way to metabolize fat is to build muscle mass, because muscles use fat as a source of energy. Muscle mass is increased by exercise. So, my strategy for post-molt conditioning/dieting is to get the hawk into the field as quickly as possible, and “hunt her into condition.” In reality, I am “flying muscle onto her,” and the fat will disappear as the muscles use it for fuel. Coming out of the molting chamber, I reduce the hawk’s weight just enough to be able to call her back to my truck at the end of the hunt, then I head for the Great Basin and start hawking. The wide open spaces and safety of sagebrush country, and the inherent tameness, sociability, and hunting desire of excellent captive-bred Harris’s hawks, make this simple conditioning strategy feasible. There is never a worry that the hawks will “spook” or lack interest in chasing game, even when hopelessly out of shape at the start of the season. [Obviously, then, this strategy is not for everyone. It requires appropriate hunting grounds and suitable hawks to be successful.]

The “hunt her into condition” method produces a highly desirable positive feedback loop. As the hawk builds muscle mass from exercise – flying and hunting – she uses up her fat stores more quickly. As her fat stores decline, her appetite becomes keener and she requires more food to sustain her. She catches and eats from her own fresh kills every day. As her muscle mass increases, she has more strength, and is able (and willing) to fly farther and with greater vigor, further increasing her muscle mass and reducing her body fat until she reaches the sought-after transcendent state. Though her transcendent weight is often very close to her molting weight, the similarity of body weights conceals the profound changes in body composition that have occurred as a result of frequent, sustained, strenuous exercise.

I still weigh my hawks before every hunt. But I no longer take pains to keep my hawks within 10g of their target weight. At transcendence I wouldn’t even know what their target weight really is. Standing on the balance for the ritual morning weigh-in, one of my Harris’s hawks, Una, lost 12g with one mighty projectile slice. Surely the weight of a single slice isn’t going to make any difference in performance one way or the other – not when a hawk is processing 100-150g of food each day, and daily weight fluctuations of 20g or more have no discernible effect on the way the hawk flies. I used to worry about feeding my hawks too much to fly well the next day, but now I worry more about making sure that they have had enough to eat!

Once a hawk is accustomed to this high-input high-output flying routine, it is a mistake to cut back drastically on her food intake in an attempt to reduce her weight. I have made this mistake myself. I was flying one of my top jack hawks, Vici, in the Great Basin of Oregon at a transcendent weight of around 1015-1040g. I planned a trip to

Wyoming to meet Tom and Jenn Coulson for a week of hawking in September, but I was concerned that the change of venue, and the extra complications of group hawking, would require a little more control of Vici than was needed when hawking by myself in Oregon.

So, in preparation for the expedition, over about a week's time I dropped Vici's weight to 976g – well above her “normal” flying weight but 40-60g lower than her transcendent weight. Her first day in Wyoming was not too inspiring. She caught 3 cottontails in fairly short order, but wasn't flying with her usual verve. I gave her a big crop, raising her weight overnight to 1009g. The next day she was back to her old self, blowing past several other hawks to roll a big white-tailed jack in a 200-yard wingtips-back pursuit. To fly like this a hawk needs to feel great, and for a transcendent metabolism it takes a lot of food every day to make her feel strong. It isn't about hunger, or weight control. It's about confidence and energy and routine.

Is it possible for a transcendent hawk to get too heavy? Yes, it is, at least for some hawks. Excessive weight eventually manifests itself as self-hunting and selectiveness on quarry – the hawk may be unwilling to take the most difficult shots. Self-hunting is reduced by using a T-perch, to which the hawks readily home. For hawks that become picky on quarry, reducing their weight slightly will bring them back into focus. My two greatest jack hawks, Shadow and Vici, retain their bloodthirstiness regardless of weight. Remember that the goal is not to see how heavy a hawk can be flown, but rather to get the best quality of flying under the prevailing conditions. This is the measure of a hawker's skill.

In my experience with Harris's hawks, the high-intensity exercise necessary to produce transcendence can only be attained by long-range pursuit flights, where the hawk is working at maximum power output for long periods. Alternative modes of hunting, such as cruising from tree to tree and stooping on cottontails, or catching rabbits in short flights, do not seem to result in the necessary flight muscle growth that underlies the transcendent metabolism. Perhaps some strenuous non-hunting exercises (*e.g.*, restrained pursuits, jump-ups) could serve this purpose, but successful hunting is at least as much about the hawk's field experience as her physical condition, so I follow the “specificity principle” of athletic training – to get better at any physical activity one must perform that specific activity as much as possible. For the elite athlete, including a hunting hawk, the value of cross training is negligible. The best way to improve hunting performance is to hunt – the more the better!

At transcendence, the hawk's flight muscles are heavy and powerful, requiring large quantities of high quality food to fuel them. Generous crops of fresh food during and

after the hunt replace the depleted glycogen in her muscles and liver, so that she has ample energy reserves for hard flying the next day. Her digestive system and metabolism are working at full throttle, giving the hawk tremendous energy and fire. She has become an elite endurance athlete. Her many kills give her confidence. A very fit, confident Harris's hawk is a wonder to behold. Nothing seems beyond her ability. Her strength, speed, and stamina produce breathtaking flights for hours on end. She has reached her full potential as a game hawk.

Good hawking!

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