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Correcting Insufficient Weight Loss in Artificially Incubated Falcon Eggs

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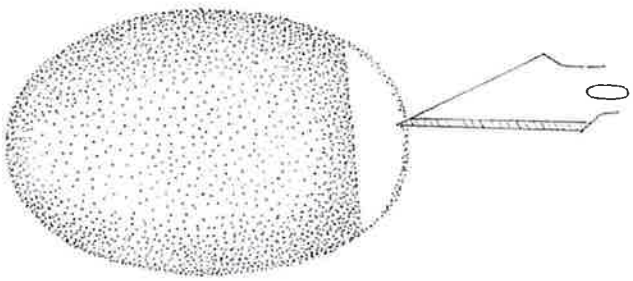
Recent experiences breeding Peruvian Aplomado Falcons (*Falco femeralis pichinchae*) indicate a trend toward insufficient egg-weight loss during artificial incubation. Standard techniques for falcon-egg incubation were adhered to. Careful tracking of egg-weight loss was monitored using an ideal-weight-loss-trend graph calculated for a loss of 14.5% over a 30 day term based on discussion with Peregrine Fund personnel (Sandfort, pers. com., 2003). The following are the results of two season's experimentation with the controlling of insufficient egg-weight loss. Results have been extremely promising, but caution is advised as with any newly developed technique. Until one is experienced in its implementation, this somewhat invasive form of intervention should be reserved for eggs that seem otherwise doomed.

Young tiercel Peruvian Aplomado Falcon.

Using a technique independently developed by Bill Meeker, of El Paso, Texas with Peregrine and Barbary Falcons, successful hatches were achieved in four out of six cases where Meeker's protocol was employed correctly before the first pip "star" appeared on the shell surface. Based on their significant lack of weight loss, most, if not all, of these chicks would certainly have died at hatch had their eggs not been corrected beforehand. The two that did not hatch were probably assailed by factors other than insufficient weight loss, most likely temperature fluctuations that occurred when the eggs were shifted from the incubator to a hatcher whose thermometers are now suspect. Until that point, the egg-weight loss had been precisely correct and the embryos viable.

After two breeding seasons of repeated insufficient weight loss in artificially incubated Aplomado eggs, we now anticipate from the outset that the problem will occur. Therefore, we contribute no humidity. With the eggs encountered, one could more easily *raise* humidity to slow down weight loss than *lower* humidity to accelerate weight loss (even when using desiccants). We accept relative humidity for what it is and focus on the egg itself. Recommended techniques such as washing, misting and sanding have proven ineffective with these uncooperative eggs. However, the most stubborn amongst them cannot resist the introduction of a "vent" at dead-center over a well-developed air cell. With every Aplomado egg, the author has incubated, the vent had to be created in order to induce and maintain proper weight loss.

A "vent" is safe to bore only after a well-defined air cell is visible during candling. This should be sufficient by 14 days. If the actual weight-loss trend continues to wander above and away from the ideal, one must bore a small opening at the top of the cell. After some experimenting, I now start



Introduction of a vent at the air cell of an incubating egg at approximately 14 days of incubation. Darkened area is living membrane surrounding embryo.

with a 1mm hole on Aplomado eggs. Larger raptor eggs (such as Peregrine or Gyrfalcon) may require a larger hole, (perhaps 2mm) at the outset in order to activate a measurable difference in weight loss.

To bore the hole, use the tip of a #11 X-acto blade (or another fine-tipped, sharp boring tool) and scratch at the surface over the center of the air cell in an "X" shaped pattern that will create a slightly-concave roughened point in the otherwise smooth and tough-coated shell. Once this "pilot" spot is established, boring becomes more efficient. Using gentle but persistent scratching and semi-rotations back and forth with the blade tip, the shell will become breached and a tiny opening (vent) established. It is important to not penetrate too deeply into the cell with the tip of the boring tool as you may damage the membrane surrounding the chick with devastating results. Rather, just barely penetrate through the shell layer itself and stop abruptly there. Further boring can be done as long as one enlarges just a fraction of a millimeter at a time. Being in a hurry to enlarge and putting too much pressure downward on the blade as one works can cause it to catch on the shell edge and crack it out or over-chip the vent. Once completed, these blade-bored holes may be irregular, triangular or rectangular rather than circular in shape.

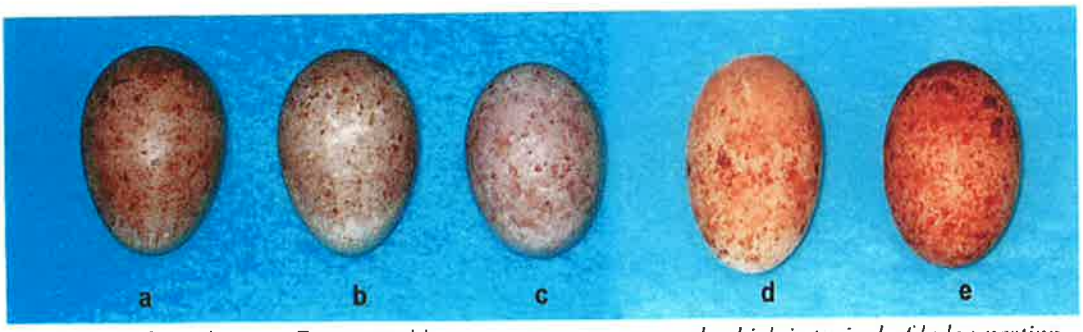
egg was initially sanded over the air cell. When failed to respond to sanding, a 1 mm vent was introduced.

After initially placing a vent, weigh the egg every three to four hours to determine if it is reacting correctly. You should observe a measurable drop in weight and be able to predict the new course of weight loss it seems to be traveling by eight to nine hours. By 24 hours you should feel confident of your results. You must now decide if the new actual-trend will intersect the plotted ideal-trend before the end of incubation. If the new slope is negligible and intersection is unlikely, you must open the hole further to encourage more weight loss. This should be done incrementally and tested over twenty-four hours before continued enlargement. There is no rush. If you start this process at fifteen days, you have plenty of time to intersect before the full term is over. A two millimeter vent should effect a significant correction at low to moderate levels of humidity. I have never made a hole larger than four millimeters in width, and then only at the eleventh hour as an emergency nose-dive down to the line.

If a gradual slope is formed, such that intersection with the ideal seems inevitable before the end of term, you may leave the hole as it is. However, as incubation proceeds, it may be necessary to further adjust weight up or down as needed.

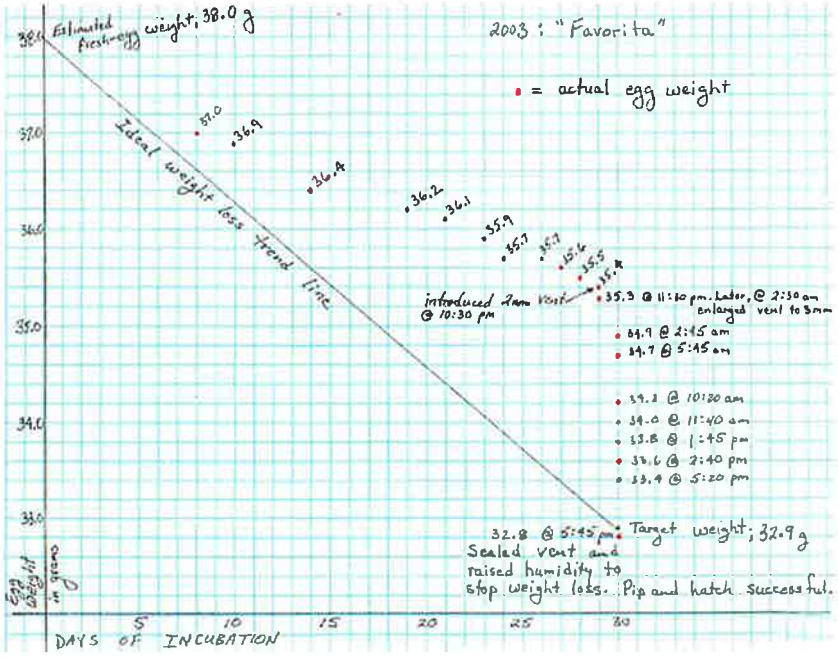
A small square of electrician's tape was used to close the vent when weight loss threatened to dip below the ideal-trend line.

If the slope is steep and intersection seems imminent, wait as long as you dare in order to cause the weight to drop as close to the ideal as you can before sealing up the vent and stabilizing weight loss. To slow or stop weight loss, seal the vent with a small piece of electrician's tape (the black-plastic type). A square piece measuring a few millimeters larger than the width of the vent is a good place to start. The tape will slow down evaporation through the vent. However, in some cases, even when the rate of loss is substantially reduced, the egg may continue to lose too rapidly to reach stasis. Therefore, if you have jockeyed the weight right down to the line, be sure to continue monitoring it and keep it at or above the line. You may need to make corrections in the opposite direction by increasing humidity, adding more tape to the shell or by applying a layer of "new skin" (liquid bandage) strategically at the top of the air cell.



Peruvian Aplomado eggs. Eggs a and b are narrower on one end, which is typical of ledge-nesting birds. Eggs c, d, and e show less differentiation at the ends, which is typical of platform nesters. Bill Meeker hypothesizes that these rounder eggs may explain why a disproportionate number of Aplomado embryos encountered (50%) got "turned around" in the egg and hatched backwards.

This "roundish" Aplomado egg shows clear evidence of a hatch "south of the equator." For a chick to pip well inside the membrane and away from the air cell is often fatal, especially if the egg is overly wet and the chick aspirates fluid. The dark dot indicates where the first "star" was anticipated. This egg was sanded, vented, then sealed with tape. Two out of four eggs hatched using this method.



My first experience with a vent was an emergency "nose dive" to the target weight in the last day.

If you are certain the egg is stable, or at least has slowed sufficiently to stay at or slightly above the line, you may return to daily weighings. If you are uncertain or feel the weight loss is accelerating, weigh every two to four hours (depending on rate of acceleration) and adjust the egg accordingly. If the egg has returned to being sluggish, the vent can be reopened by inserting a needle through the tape right at the location of the vent beneath it. The needle hole can be enlarged or compressed and, since you are now adjusting the hole in the plastic tape instead of the egg shell, you can work with greater confidence. Creating this "valve" is also a safer approach (to re-activate an egg to lose more weight) than is actually removing tape if it has been applied over a previously sanded area. The sticky back of the tape can cause the sanded area of the shell to peel away, like paint peeling off a wall where masking tape has been applied and then later removed. Removing tape from *unsanded* shell is usually safe to do. In the event that weight accidentally drops below the ideal, put the egg on a holding pattern by sealing the vent (as described in detail below) and stopping weight loss. Humidity can be increased if sealing the vent is not enough by itself to stop the loss (but it almost always is). Weigh the egg periodically until the egg's actual weight intersects again with the ideal.

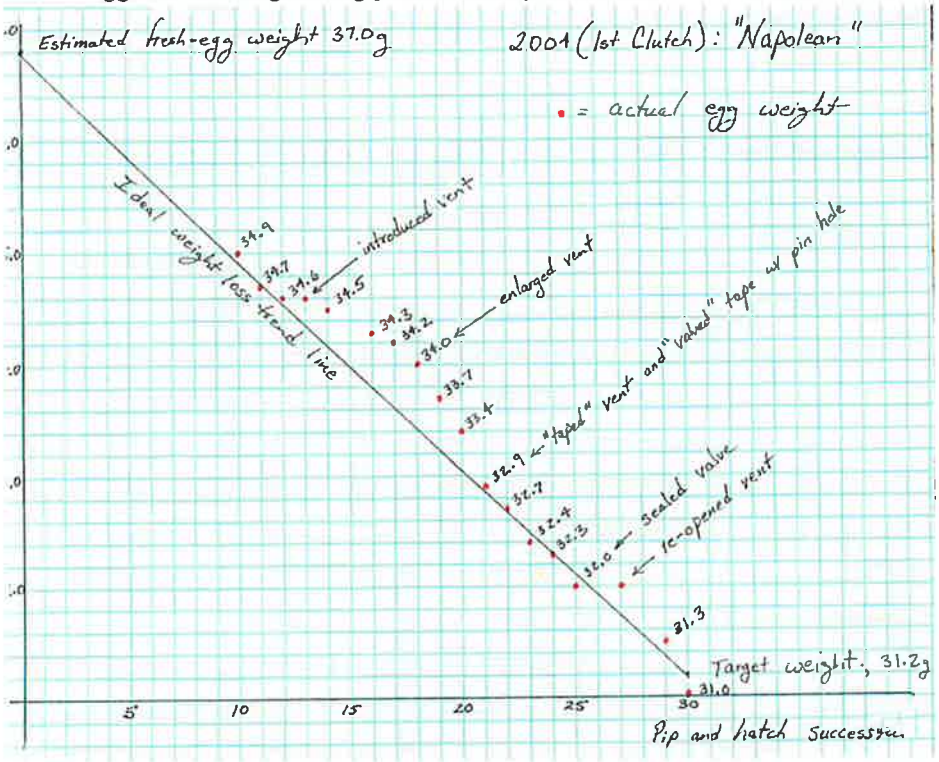
Serious danger of over-doing weight loss coincides with the last days before pip. At that point, you have fewer days left in which to correct an error. For that reason, I prefer to maintain the weight slightly above the ideal until the end of term, at which point it is easy to predict and control the amount of weight needed to be reduced. If enlargement of the vent is done carefully and incrementally, and the egg is weighed every several hours until intersection with the ideal is realized, I can usually make a "three point landing" with the egg's actual weight being on the line (or just above or below it) at the time of pip.

Using Bill Meeker's air-cell venting protocol, it is possible to have a high degree of control on the weight loss of seriously-problematic falcon eggs. This

A large downy Aplomado Falcon.

technique should be reserved for cases where it is known that to not intervene will probably result in the loss of an otherwise viable egg. When "star" occurs, the egg must be moved to a hatcher with increased humidity. Be prepared to wait. These eggs can move agonizingly slow at this point. Hatch has occurred as early as 36 hours and as late as two or three days after the initial star appeared. One should not be in a hurry to intervene as the chicks may undergo periods of comatose-like quiescence lasting upward to twenty hours before bursting into action and hatching out.

Meeker pioneered this technique on Peregrine and Barbary Falcon eggs that would otherwise have been lost at pip due to significantly insufficient egg-weight loss. His technique has thus far proven to be essential for the correcting weight loss of every artificially incubated Peruvian Aplomado Falcon egg encountered by the author. In subsequent discussions with raptor breeders, such as Danny Ertsgaard, we learned that similar venting techniques have been independently innovated by others as well. Caution should be taken that all eggs are otherwise treated precisely as they should be in terms of temperature, rotation, and all other aspects of incubation protocol. Weight-loss trend lines must be accurate and reflect the correct ideal trend of weight loss for that egg. Hands should be thoroughly washed with hot soapy water before handling eggs. Prophylactic measures should be taken to keep the incubator and its surrounding environment as clean as possible as bacterial contamination into the air cell and through the living membrane remains a concern once the shell is breached.



My second experience with venting shows earlier intervention and more control throughout. The other two eggs graphed similarly, and all three eggs hatched.