AN OVERVIEW OF THE ARTIFICAL INCUBATION OF PARROT EGGS

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The science of artificial incubation is one that is only perfected with practise, often with species that are not worth much economically or ecologically, yet often become the most favoured bird when it actually makes it onto the perch. Artificial incubation is a time consuming, often expensive and very involved process, especially with parrot species. Yet, it can be extremely rewarding and gratifying when the chick hatches out.

There are many good reasons for putting valuable time and effort into artificially incubating eggs and doing it well, but the primary one is to dramatically increase egg production. Due to the habit of female birds relaying when there is an unexpected loss of eggs from the nest, parrots can often be triggered into laying two or more clutches in any one season by removing the eggs for artificial incubation.

Artificial incubation can produce positive results for breeders who have problem birds who lay but break their eggs or who not brood properly.

Artificial incubation can be very helpful in control of certain diseases such as Psittacosis, Psittacine Beak and Feather disease and Pacheco's virus.

The technology of incubation can be used in the conservation and/or salvage management of parrots under threat in their natural habitat by allowing either:

- The eggs which would have been lost due to ecological disturbance after egg laying to be collected and then their development to be completed under controlled conditions, or

- By collecting eggs of endangered species in undisturbed habitats of wild populations, relaying can be stimulated and thus dramatically speed up the population production rate. The harvested eggs, after artificial incubation and chick rearing, can either be rehabilitated back into the natural population or placed in captive facilities to increase captive populations.

INCUBATORS

There are numerous different brands of incubators available but there are two basics types, namely, the still-air or moving air form. Our own preference and by far the most common type are the moving air incubator. In general, the moving air incubators are much better at providing the environmental parameters required for incubating parrot eggs.

Incubators

The incubator has four major functions and they are:

- **Providing an appropriate temperature regime.**
- **Providing an appropriate humidity regime.**
- **Providing an appropriate egg turning regime.**
- **Providing an appropriate hygiene regime.**

The variety of incubators available vary in how they provide for the above four parameters

While the various brands of incubators vary in their ability to maintain a suitable environment, in general, the better ones are also quite expensive. After trialing and modifying many different brands, we are now getting our best results from the A.B. Incubator range. However, we acknowledge that 50 % of the success achieve in artificially incubating eggs arises from the skill of the operator, not the sophistication of the equipment.

To maintain incubators at their optimum operating parameters, it is a very good idea to maintain the incubators in a room that will not fluctuate greatly in terms of temperature and humidity. This generally means that incubators work best in a room that is not commonly walked through, draughty or exposed to direct sunlight.

The following briefly describes how we manage our incubators for the key parameters:

i. **TEMPERATURE:** Correct temperature settings are critical to embryo development. Cool temperatures retard development and proper water loss while high temperatures accelerate development, dehydrate embryos and will also kill the embryo. The complex processes that occur in the development of an embryo development will not all be coordinated in structure and function unless the temperature is correct. However, there is a degree of tolerance of temperature variation by the developing embryo with most parrot species which is about ±0.5^{o}C (1^{o}F).

Our Target Incubator Temperature is 37.2 ^{0} C = 99.0 ^{0} F
Range 36.9 ^{0} C - 37.9 ^{0} C = (98.4 ^{0} F – 100.2 ^{0} F)

Target Hatcher Temperature 36.4 ^{0} C = 97.5 ^{0} F

ii. **HUMIDITY:** The humidity in the incubator controls the fluid or weight loss of an egg during incubation and thus has a marked affect on chick health and strength. In general, to produce a healthy chick, a target % weight loss of 14 to 16 % (commonly 15%) is required from the start of the incubation to when the egg externally pips. The rate of water loss is dependent upon shell thickness, porosity and water vapour concentration in the atmosphere around the egg. Humidity is calculated by taking a wet bulb temperature reading and noting the difference to that of a dry bulb thermometer and reading off from an appropriate humidity table. Alternatively, relative humidity can be read directly off a hygrometer. We use a small dial hygrometer that is accurate and very easy to use.

The only way to determine if the weight lost by an individual egg is correct is to monitor weight regularly (we do it every second or third day) with scales weighing in 1/100's of gram. It then can be determined if the egg is losing too little or too much moisture. By using various techniques it is possible to alter the weight loss of each individually incubated egg.

Our Target Incubator Humidity: – variable but dependent on weight loss, but normally in the range of 40 to 50% RH for quality eggs.
Target Hatcher Humidity – 75% ++ RH

The more expensive incubators have automatic humidity control – you just dial the humidity required and the machine does the rest. However, small dishes of distilled water will often provide adequate humidity, especially if it is being monitored by a dial hygrometer, and frequently requires less maintenance.

EGG TURNING: The manner of turning the egg is essential to the development of the allantoic membrane (veins), maximising growth and minimising adhesions and disruptions of embryonic membranes and to decrease the possibility of the chick malpositioning within the egg. Rob Harvey from the UK recently postulated and provided supporting data that eggs from species that have a small percentage of yolk need more turning than eggs having a large proportion of yolk. He found that parrot eggs have a yolk of around 20% to 30%, which is less then the 35 % normally found in poultry eggs and thus would not develop properly when turned by rocking 45 degrees from the vertical 24 times a day. He argues that parrots should be set on rollers or in moving carpet incubators, which can provide more natural turning. This results in normal vein growth and successful hatching.

By manipulating how the egg is turned, the egg turning frequency and the amount the egg is turned at each turn, we are consistently achieving complete (100%) allantoic membrane (vein) coverage by a maximum of 52% of the incubation period. This development is critical to the success in hatching out many of our smaller parrot eggs.

iii. **HYGIENE:** Traditionally, incubators were cleaned by gassing with formaldehyde. This method is still extremely effective but it is highly carcinogenic. Nowadays we spray and wipe with **Virkon S,** which is very effective and is much safer to the environment. Virkon S can also be used for dipping and cleaning dirty eggs

ESSENTIAL EQUIPMENT

The following gives a brief summary of what we consider to be basic equipment for incubating parrot eggs:

- **INCUBATOR** - We believe the best for parrots are moving air types with either eggs placed on their sides on rollers, or a moving base that rolls the eggs between holding walls or rods. Incubators with trays into which the pointed egg end is placed and the tray tilts the egg through 90^{0} are not recommended to start the incubation process but may be used in the second half of the incubation period. Some incubators incorporate both methods concurrently.

  Automatic humidity control, while an excellent feature to have, is not necessary once skill levels improve.

  Incubators with solid state electronic sensing devices and insulated cabinets make it easier to maintain continuity in the environment for the eggs. Incubators with microprocessor temperature controllers are able to maintain temperature stability of less then $\pm 0.1^{0}$ C, even in widely fluctuating ambient conditions. The airflow in the incubator is also a critical factor in the design. – The machine should provide an even distribution of heat, humidity and air.

- **HATCHER** - A small moving air hatcher, which recovers both temperature and humidity quickly, will significantly improve the quality of the chick hatched.

- **SCALES** - Used to weigh eggs with an accuracy of at least 0.01grams, preferably 0.001 grams.

- **EGG CANDLERS** - Used to view and check all matters pertaining to the egg and the subsequent embryo development. Most of us start with a small battery powered type but if you can afford it, a high intensity type that does not damage the egg by heating, are excellent. The high intensity Cool Lume Candling Light made by Brinsea is by far the best candling light we have used.

- **THERMOMETERS** - When trying to understand how your incubator works, a number of calibrated thermometers are essential. Nowadays we use digital thermometers, which we check, and calibrate to identify their error when read. These can be purchased cheaply.

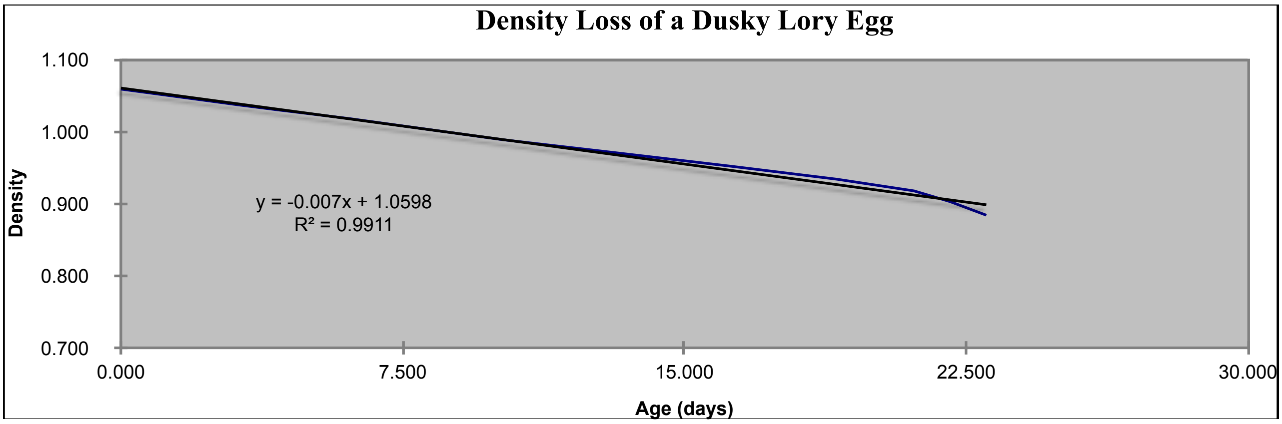
- **HUMIDITY METERS** - Traditionally, and still widely used, humidity is determined by comparing a dry bulb temperature against a wet bulb temperature.

We prefer, however, to use small dial hygrometers that display humidity as % RH. Their accuracy is about ± 5%, they can be calibrated and their cost is minimal.

- **DATA RECORDING SYSTEM** - The recording of your incubation data is essential to analyse your successes and failures and to improve your future success rate. A good data-recording sheet is essential. We monitor temperature, humidity, egg turning, position of the egg, vein growth, and weight and density loss and hatch details.

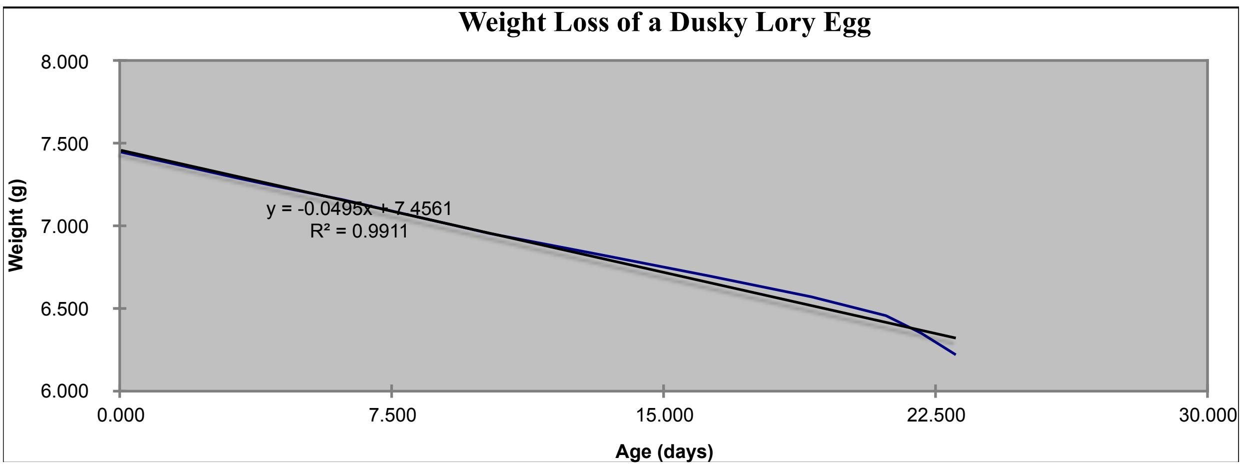
- **VERNIER CALIPERS** - These are essential to measure your egg's dimension, to calculate such things as egg volume, or initial start weights when they are unknown.

MONITORING / DATA RECORDING



The essential key to successful incubating is monitoring. We monitor not only incubator temperature and humidity against time but also weight and density loss of the egg. By also recording vein coverage in the egg against time we can also determine if our egg turning parameters are likely to produce a viable chick. Some of the formulas we use a shown in the attached table 1. A sample of our data-recording sheet is shown (table 2).

A correct temperature regime is essential to maximise your success rate. The humidity will determine weight loss or fluid loss of the egg over the incubation period, which will have a marked affect on the hatchability of the chick.



However, once the pattern of weight loss has been started, subsequent changes to humidity do not tend to have a marked effect. By monitoring density changes it is possible to predict incubation commencement times when this is unknown. It is possible to determine weight loss rates when the fresh weights are unknown and the incubation time is unknown. All parrot eggs should have a density reduction of 0.006 g/cm^3/day. A high initial density also implies a thick eggshell and thus will probably need a lower humidity than normal. Figure 1 & 2 shows the weight and density loss of a lory egg over the incubation period.

Figure 1: shows the weight loss of a dusky lory egg over the incubation period
Figure 2: Shows the density loss of a dusky lory egg of the incubation period, the sharp to cline at the end of both figure 1 and 2 is the time of external piping

THE TECHNOLOGY OF HATCHING

A hatcher is normally set at about 1^{0}C below the incubator temperature and has maximum humidity. Hatching usually starts 3 to 4 days prior to the expected hatch date. If the weight loss trend is above 15% we advise that the egg be moved to the hatcher once drawdown has commenced. In contrast, if the weight loss is below 12% then keep the egg in the drier incubator until external pip has occurred. The time between external pipping and hatching is normally one to three days.

If hatching assistance is required then it is usually the result of a problem with the incubator control parameters. The skills required and techniques used in hatching assistance are a separate issue.

TROUBLE SHOOTING

So your egg didn’t hatch! Why? Well the reasons are many and varied and not possible to fully discuss here. However, we can divide the incubator process into critical periods and then look for reasons.

- **Parent Bird Husbandry** - look at pair bonding, compatibility, nutrition, genetic diversity, environmental breeding stimuli.
- **Egg Collecting** - time between laying and setting in incubator, temperature regime during collection, methodology of egg storage before setting.
- **Egg Quality** - shell damage, inner membrane damage, contamination.
- **Egg Dipping** - necessary or not, chemicals used, temperature regime of process.

- **Incubation** - temperature, humidity, egg turning regimes, hygiene, vibration in incubator, handling techniques, thermometer calibration, incubator temperature differential throughout, possible diseases, incubator ventilation.
- **Hatching** - temperature and humidity regimes, handling techniques, hatcher tray surface, hatching assistance technology and skills.

This is a brief overview of how we incubate parrot eggs. It is now up to you, the reader, to have a go. We believe, to develop a deeper understanding of the art of incubation, one needs to understand the many factors that are working for or against the development of an embryo. No matter to what degree you become involved in incubation; rest assured that those who do so will become hooked on a fascinating part of aviculture. Please do not hesitate to contact us for suggestions, problems and any ideas you may have.

Table 1: shows the formulas that are used to monitor the progression of the egg through out the incubation period

Incubation Formulas

Measurement Units

Length (L) -Centimetres (3 decimal places)
Weight (W) -Grams (4 decimal places)
Time (T) -Days (3 decimal places)
Volume (V) -Cubic Centimetres (4 decimal places)
Density (D) -g/cm^3/day (4 decimal places)

1. Time Period calculation: [Time (mins)/60 + Time (hours)]/ 24 + days

   eg. Initial Start Time (T_1) = 1350 Hrs 6/1/97
   Time of Period (T_2) = 0715 Hrs 13/1/97
   Therefore $T_1 – T_2$ = [(10/60 + 10)/24] + 6+[(15/60 +7)/24]
   = 0.424 + 6 + 0.302
   = 6.726 days

2. Estimated Egg Fresh Weight (when unknown):
   = Length x Breath x Breadth x 0.548
3. Daily Weight Loss Target:
   = Fresh Laid Weight x Desired % Loss to pip) / Number of Days to Pip
4. Estimated % Weight Loss Trend at Time T(t)
   = {{[(Fresh Weight – Actual Weight at T(t)) / T(t)] x Estimate Days to Pip} / Fresh Weight} x 100
5. Egg Volume: = Length x Breadth x Breadth x 0.51
5. Egg Density: = Egg Weight/ Egg Volume
6. Estimated Daily Change in Egg Density:
   = [Egg density at time T(1) – Egg Density at Time T(2)] /
   Time T(2) – Time T(1)

Table 2: This table shows the data sheet that we use to record our information we obtain through out the incubation period.

Egg Incubation Records

Species:____________________ Length (cm): __________.
Flight: ____________________ Breadth (cm):__________.
Egg Number:____________________ Lay Date:__________.
Fresh Weight (g):____________________ Collection Date:__________.
Egg Volume (cm^3): ____________________ Egg Condition at Collect:________.

Incubator Model: Serial No:
Incubation Parameters: DBT: RH: Turning Regime:
Notes:

Day # Notes Actual Weight(g) Density(cm^3) Veins Date Time

Expected Incubation Period:___________________
Expected Days to Pip:________________________

SOME SOURCES OF FURTHER INFORMATION

Anderson Brown, Dr A F, and G E S Robbins (1994) – **The New Incubation Book** -revised edition –BPC Wheatons Ltd

Harvey, Rob L. (1996) **– Practical Incubation –The Video With Rob Harvey**

Harvey, Rob L. (1993) **– Practical Incubation** -Revised edition – Hancock House

Jordan, Rick (1989) - **Parrot Incubation Procedures** -Black Cockatoo Press