ARTIFICIAL INCUBATION and HAND REARING OF RAMPHASTIDS

Ramphastid Conservancy
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The Ramphastid Conservancy works exclusively with Ramphastids.
It was founded in 1986 and has 151 birds from 17 species of toucan (as of April 2001).
Chick #110 was banded in 2000.

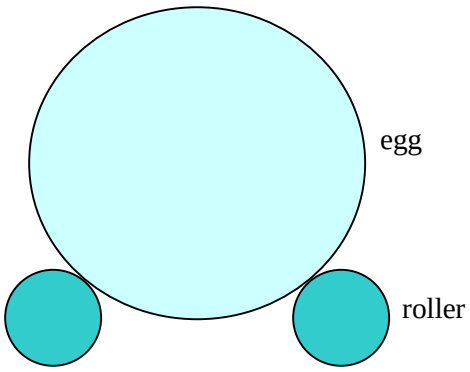
Ideal Situation:

- Reliable, experienced conscientious parental incubation and rearing
- Indications for Intervention
  - nest abandonment
  - inexperienced or young parents
  - interpair aggression – usually male aggression toward female (reverse also observed)
  - extraneous interference
  - other birds in proximity
  - caregivers
- Environmental conditions
  - temperature extremes (>101° F)
  - loud noises
  - storms
- Parental history of destruction of eggs or young
- Fragile eggs
- Rarity of species
- Environmental conditions hostile to proper egg development or young development
  - temperature extremes
  - humidity extremes
  - insects (e.g. fire ants)

- Caregivers desire for pair to “reclutch” and increase production (possibly helpful for rare species but potentially unhealthy for producing female)
- Facility
  - Dedicated Incubation Room
    - quiet, dark, minimal traffic area
    - temperature controlled
    - humidity controlled
    - antivibration table for incubators
    - sink

- Equipment
  - accurate, high quality incubator
    - recommend Grumbach
    - minimum – 2 machines
    - ideal – 3 machines
  - accurate, calibrated thermometers
    - 2 per incubator
    - capable of accuracy to 1/10th degree C
  - accurate, calibrated hygrometer
    - 2 per incubator
    - capable of accuracy to 1% relative humidity
  - accurate scale
    - recommend Ohaus electronic
    - capable of accuracy to 1/1000th gram
  - calculator
  - candling device

- Preparation For Incubation
  - equipment needs to be thoroughly cleaned and disinfected (recommend Hibiclens)
  - incubators need to be running and calibrated for minimum of 1 week prior to use (longer is better)
  - set rollers



  - calibrate thermometers and hygrometers
  - use sterile water for humidity

- Egg Collection
  - wear latex gloves – Ramphastid eggs are very porous and therefore bacteria and oil from human skin could be harmful
  - use well padded collection container (sterile cotton 4X4's)
    - Ramphastid eggs are thinner shelled and more fragile than Psittacine eggs and can be easily damaged; transport horizontally to protect internal membranes
  - replace with dummy eggs
  - Do Not Store – incubate as soon as collected

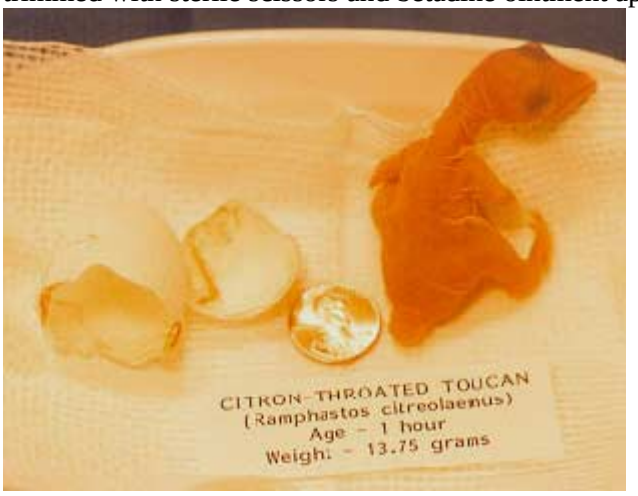
- Egg Cleaning
  - probably reduces risk of infection later and reduces risk of cross contamination within incubator
  - remove gross soiling with sterile scalpel blade using very gentle scraping
  - we use dilute solution of Hibiclens and sterile water and gently clean with a soaked sterile cotton 4X4
  - after cleaning, rinse in warm sterile water
  - solution for cleaning must be warmer than egg (if egg is warmer, solution and surface bacteria may be drawn inside egg)
  - CAUTION: eggs become very slippery when wet due to protein layer of shell (cuticle)

- Weighing and Weight Loss Calculation
  - weigh egg very accurately (to 1/1000th gram) prior to beginning incubation
  - during normal incubation, eggs will lose a percentage of their weight due to loss of water and metabolism of the yolk as the embryo grows and develops
  - each species has an ideal weight loss percentage – for Ramphastids we have found it to be 12 to 13 percent.
  - calculate weight loss over 16 day incubation cycle and determine ideal daily loss in grams
  - perform baseline candling

- Incubation
  - Initial Parameters:
    Temperature: 37.1° C
    Relative Humidity: 59%
    Turning: hourly
  - have three incubators running – all at 37.1 ° C and Relative Humidity of 56%, 59%, and 62%
  - weigh and candle each egg daily at same time to plot weight loss and observe development
  - deviation from ideal weight loss: move egg to higher humidity incubator if weight loss is too great; move egg to lower humidity incubator if weight loss is inadequate
  - Inadequate Weight Loss – chick will be large, edematous, and probably too weak to hatch
  - Too Great Weight Loss – chick will be dehydrated, weak, probably die in the shell or die during hatching from weakness and sticky shell membranes

- Egg Development
    - Day 1 – airspace small (3% Egg Volume – EV); yolk small and floats slowly; no vessel development
    - Days 2-3 – not much change except yolk slightly enlarges and floats ever more slowly
    - Day 4 – yolk dramatically enlarges, flattens out and remains fixed; vessels may be visible
    - Day 5 – beginning vessel formation visible; 1/16th to 1/8th inch embryo with visible heartbeat; yolk 35-40% EV; airspace approx. 7% EV
    - Day 6 – embryo 1/4th inch; yolk 50% EV; vessel growth progressing rapidly
    - Day 7 – increased vessel growth; embryo movement visible; yolk 55-60% EV; embryo 3/8th inch
    - Day 8 – yolk 65% EV; vessel growth continues
    - Day 9 – yolk 70% EV; embryo ½ inch; airspace 8% EV
    - Day 10 – 100% vessel growth over inside of egg; airspace 10% EV
    - Days 11-14 – airspace gradually increases; embryo size increases; movement increases
    - Day 14 – egg color darkens and becomes mottled; air space "draws down"
    - Day 15 – internal pip occurs; chick moves into airspace; movement observed in response to light and sound; begins vocalizing
    - Day 16 – hatching completed

- as soon as internal pip occurs, stop automatic turning and place in padded tray (sterile cotton 4X4's) in hatcher with settings: temperature 37.1° C and relative humidity 85 to 90%
- monitor progress – slow at first; chick may make 1 chip in shell as infrequently as every 2 to 3 hours; the chick responds to light and sound and continues to periodically vocalize; it will probably take 8 to 12 hours from external pip to hatch; majority of progress occurs in the last 45 minutes to one hour; by day 16, shell is VERY thin and fragile due to calcium absorption by the developing chick
- upon hatching, we clean the chick (residual membrane and shell fragments) with sterile cotton tipped applicators dipped in warm, sterile water; umbilicus is trimmed with sterile scissors and betadine ointment applied



- Initial Care of Chick
  - obtain baseline weight
  - first feeding – warm Pedialyte within 1 hour of hatching
  - obtain cultures for gram negative bacteria from chick's nasopharynx and esophagus (MacConkey media)
  - bacterial inoculation – 2 days prior to expected hatch date we perform bacterial cultures on 3 healthy adult birds; we use MacConkey and blood agar (MacConkey to check for gram negative bacteria and blood agar to verify heterogeneous bacterial flora); we then inoculate the newly hatched chick shortly after hatching (after obtaining baseline cultures on the chick) and then every 12 hours for a total of 3 inoculations; this serves to establish normal bacteria in the chick and reduces the risk of an opportunistic bacterial infection (the chick is sterile at time of hatching and is normally inoculated by the parents)
  - first feeding of formula – approximately 2 hours after hatching
  - Ramphastid chicks are very prone to dehydration and hypothermia; therefore we keep brooder very warm and humid initially; example: Day 1 – temperature 96° F and relative humidity 90%; initial formula used during the first week has a higher proportion of water than the formula used later for this same reason (mixture has consistency of watery ketchup)

- Hand Feeding Formula
  - Newly Hatched to 7 days of Age
    - Mix: 4 level scoops of Kaytee Exact Hand Feeding Formula
8 ounces Papaya Concentrate
4 ounces Pedialyte plain

  - Day 8 to Day 21
    - Mix: 6 level scoops of Kaytee Exact Hand Feeding Formula
12 ounces Papaya Concentrate
4 ounces Pedialyte plain

  - newly hatched formula is drawn up in 1 ml and 3 ml syringes and frozen for storage
  - older formula is drawn up in 3 ml, 5 ml, and 10 ml syringes and frozen for storage
  - to thaw: place syringe in brooder with chick and it thaws very quickly

- Brooder
  - we use "The Brooder" by Dean's Animal Supply (very accurate digital controls, fan, observation lid)
  - Ramphastid chicks need to be kept in low light environment (very responsive to shadows)
  - place calibrated thermometer and hygrometer inside brooder
  - bottom of brooder – place clean, white terry cloth towel soaked in dilute mixture of Hibiclens and sterile water (to prevent bacterial and fungal growth)
  - chick is kept in Corningware bowl with either cotton 4X4's or absorbent paper towels on bottom of bowl
  - we use Corningware bowls :
    - easily cleaned and sanitized
    - heavy (more difficult to knock over)
    - retain heat when chick outside of brooder

- roll up a paper towel or 4X4 for baby to lop head over

- Daily Care
  - clean chick in AM to remove soiling from over night (use warm water and 4X4's)
  - inspect feces for color, consistency, foreign material (e.g. palm log dust if chick hatched in log) and abdominal girth change from evening before
  - obtain accurate weight
  - calculate Nystatin dose: 0.0033 ml per gram (1 ml per 300 grams) given twice daily by mouth until 6 weeks of age
  - Hand Feeding Record
  - indicators of proper growth and health status -
    - weight gain
    - feeding response
    - shadow response (stimulate baby by passing hand over)
    - physiologic and anatomic developmental milestones:
      - feather sheaths
      - skin color changes
      - beak growth and color changes
      - eye slit formation
      - behavioral changes

Hand Feeding Record

Species:
Parents:
Hatch date / time:
Intial weight:
Band #
Sex:

Date	Time	Age /days	Weight/ grams	Shadow response	Feeding response	Feeding/ ml	Feed interval/ hours	Brooder temp/ °F	Brooder humidity (%RH)	Nystatin dose/ ml	Comments

- Hand Feeding
  - Feeding Equipment – individual stainless steel curved feeding needles (18 G through 12 G) or IV catheters (Jelco or Cathlon 16 G and 14 G – made of teflon and very safe and disposable)
  - store feeding needles in container with solution of water and Hibiclens between feedings

- Initial Formula – very small amounts every 1 to 1 ½ hours
  - Note: Ramphastids do not have a crop and you cannot tell by visual inspection as easily as other species if they are full or not; aspiration is a significant risk if you overfeed; it is best to feed smaller quantities at more frequent intervals and leave them slightly hungry
  - Example: newly hatched Green Aracari or Saffron Toucanet (weight: 6 to 8 grams) – first feeding consists of 0.05 to 0.1 ml per swallow for a total of 0.4 to 0.5 ml per feeding every 1 to 1 ½ hours
- usually first feeding of day is slightly larger than others during the rest of the day; quantity per feeding may slightly decline and interval slightly increase over the course of the day
- we feed from 6 AM through 10:30 PM
- give first feeding of day and then give AM dose of Nystatin
- during first week – first feeding of day is split between ½ portion of formula and ½ portion of Pedialyte plain
- abdominal girth will gradually increase over the day
- Ramphastid chicks' abdominal walls are very thin and abdominal organs (including proventriculus) are easily visualized

- use dilute formula until 7 days of age (to provide extra hydration)
- use thicker formula until 21 days of age (to provide extra calories)
- we use formula longer due to the fact that it provides more calories per unit of volume than fruit and can be stored in sterile conditions and reduce risk of yeast infections
- around Day 20 or 21, chick does not want feeding needle any longer and readily starts accepting solid food offered with forceps
- start supplementing needle feedings with pellets soaked in Pedialyte plain or fruit juice around Day 20
- we use Scenic Pelleted Diet (Red Apple Jungle and Red Apple Paradise) manufactured by Marion Zoological
    - low iron content
    - young and adult birds eat it readily
    - can be fed dry
- each clutch of chicks have own individual container of fruit and individual feeding forceps
- DO NOT feed vegetables in food mix for first 3 to 4 weeks (for both parent raised and hand raised chicks) – can cause intestinal obstruction

- Live Food
    - ABSOLUTELY NO CRICKETS: poor nutritional value, carry disease, and cause intestinal obstruction
    - Meal Worms: birds like them and they do provide some nutritional value
        - Problems: bacterial contamination
            - attract fire ants (both live worms and digested worms)
    - we no longer use any type of live food
- Care of Older Chick
    - quantity of formula fed is gradually increased as chick tolerates and feeding interval is gradually increased to every 1 ½ hours

- brooder temperature and humidity are gradually decreased over the first 4 weeks as the chick tolerates and as feather sheaths develop

- Weaning
  - chicks start perching around 5 to 6 weeks of age while still being hand fed
  - first offer water – they will quickly learn to drink and bathe
  - next offer food in bowl in weaning cage; to encourage them to eat out of bowl, offer them food held in forceps over bowl and pick food up out of bowl
  - continue to weigh daily
  - supplement their feeding until they are able to maintain weight while eating on own
  - chicks typically will lose weight when beginning to perch and eat on own
  - at age 8 weeks, switch to weekly weights – chick should be fully eating on own by this age and maintaining weight