Increasing survival of wild macaw chicks using foster parents

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Conservation Problem

- ✓ Scarlet macaw is endangered in Central America and declining in South America
- ✓ About 22% of all hatched chicks die of starvation → **Starvation is the most common cause of chick death**
- ✓ Chick starvation is related to hatching order → younger chicks in the brood died by starvation more.
- ✓ Chick starvation is driven by age difference → greater age difference higher risk of starvation for younger chicks. **ALL 3rd & 4th chicks starve to death.**

Study Site

- ✓ Tambopata Research Center (TRC), southeastern Peru
- ✓ Between Tambopata National Reserve (275,000 ha) and Bahuaja-Sonene National Park (537,000 ha).
- ✓ Tropical moist forest, rainfall ~3200 mm/year

Peru, South America

Figure 1.
Study Species: The Scarlet Macaw
(*Ara macao macao*)

Breeding Biology in Tambopata:
Brood Size = 1 to 4 chicks
Fledge = 1.3 chicks /nest

Foster Parents in Avian Population Management

- ✓ Technique with great potential to aid in the recovery of highly endangered species.
- ✓ Few studies have shown how to accomplish this successfully [1,2,3,4]

Objectives

To develop and test new techniques to increase survival of Scarlet Macaw chicks in the wild by reducing chick starvation using foster parents.

Hypothesis

Placing chicks at risk of starvation in nests with only one chick at the same age/developmental stage will reduce their risk of death by starvation.

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Figure 2. Third chick that was removed from its nest and placed in a new nest

1. Macaw chicks with high probability of death by starvation were removed from their original nests at hatching.

Criteria for chick removal: Chicks >3 days younger than 1st Chick were pulled out of their nests

Table 1. Criteria for chick removal from original nest.

Age difference between 1st chick and 2nd chick (days)	Probability of death by Starvation
0 to 2	6%
3 to 4	24%
5 +	80%

Figure 3. Chicks were syringe fed commercial macaw chick formula (Zupreem Embrace)

2. Chicks were hand raised in research station until they opened their eyes (~age 20 days)

Figure 4. Chicks were kept in brooder (wooden box with heat source)

3. Individual chicks were placed in receiver nests with only one chick that was in the same "developmental stage" but not necessarily the same age.

Figure 5. Translocated chick (left) and resident chick (right)

Picture showing graphic explanation of two chicks at the same "developmental stage".
Chicks are five days apart but they "look similar". Both have eyes open, up right position, black pin feathers under skin and tiny pins of primary feathers

4. Receiver nest was intensively monitored during 10 days after foster chick was placed
   a. Receiver nest was monitored using video security cameras 12 hours per day and feedings/chick per day were counted
   b. Foster chick was checked twice per day (5am & 5pm)
   c. Weight of resident and foster chick were taken once per day.
   d. Supplemental food was provided when foster chick crop was found half empty once or twice per day.

Acceptance Analysis # 1 :
To monitor acceptance process, we use the chick feeding ratios
Foster & resident chick feedings/day were counted for each studied nest using 6 to 12 hour long observations

Acceptance Analysis #2:
To document foster chick quality and acceptance we use Chick Growth Rates
Foster chicks growth rates were compared with wild chicks from previous seasons (N=83 chicks, 17 seasons)

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METHODS

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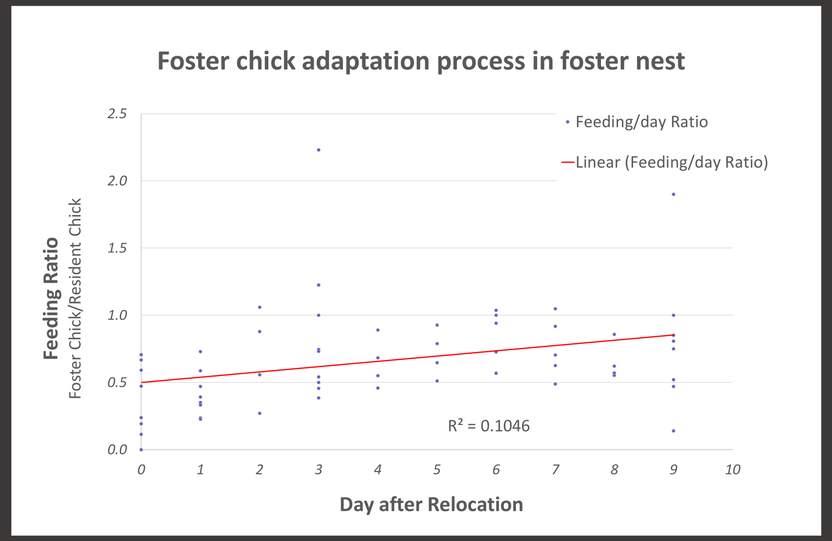
Figure 6. Foster chicks were initially fed less than resident chicks, but feeding ratio slowly increased until feedings were similar for both chicks.



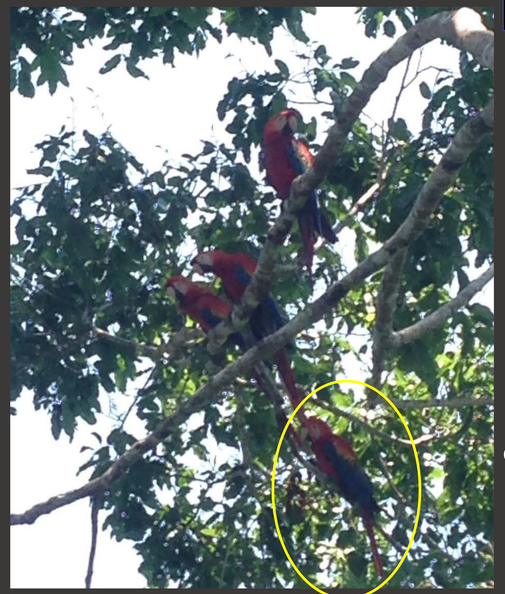


Figure 7. Foster chick (low right) seen around foster nest with the rest of foster family, seven months after fledging (Oct 2017)

Table 2: Growth of foster chicks is similar to wild chicks. Both reach similar size (▲) and grow at similar rate (▲)

Chick Type	# Individuals	Maximun Growth A (Mean)	Growth Rate B (Mean)	Age at Maximun Growth C (Mean)
Foster Chicks	13	1004 ▲	0.118 ▲	24.4 ▲
Wild Chicks	83	1015 ▲	0.116 ▲	26.2 ▲

Growth model : Logistic. t test "A" : $p > 0.05$ / t test "B" : $p > 0.05$ / t test "C": $p = 0.002$

Foster chicks reached max. growth at a younger age **

** Consequence of the hand raised technique used. In the nursery, chicks are fed big portions and often in order to get them extra fat and ready for the adaptation process in their new nests.

Figure 8. Foster chick (left) seen at clay lick , six months after fledging (Sep 2018). Note two bands, one on each leg

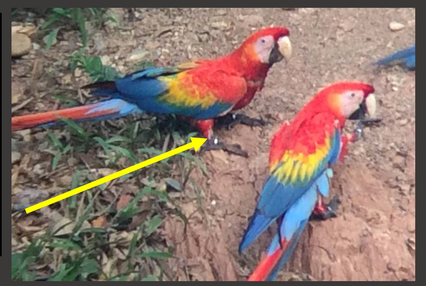


Table 3. Influence of chick relocation on breeding success:

- More chicks fledge (●)
- More nests with fledglings (●)
- Less chicks died of starvation (●)

Foster chicks = 15
Breeding seasons = 2

	Chicks that Fledge	Available nest with chick that fledge	Chicks that died by starvation
Breeding Seasons without foster parents project Average (n=16 years)	48%	17%	19%
Breeding Season with foster parents project Average (n=2 years)	↑ 70% ●	↑ 25% ●	↓ 4% ●

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RESULTS

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100% of translocated chicks were successfully accepted by wild foster parents & 93% fledge successfully
(N=15 chicks, 2 breeding seasons)

Previous studies showed higher foster chick rejection than what we found: WHY ?

- ✓ We matched ages/developmental stages between foster siblings
- ✓ We waited until risk of death by starvation passed (chick ages over 20 days old)
- ✓ We provided supplemental food to foster chick during first 10 days after relocation
- ✓ Our measure of acceptance/rejection considered that foster chick acceptance is a SLOW process
- ✓ We integrated knowledge from parrot ecology, avian veterinary and aviculture techniques.

This research was inspired by Scarlet Macaws conservation practitioners from Guatemala (WCS Guatemala, Rony Garcia) that are using this technique on the ground for many years.

Picture 10. Our "Supplemental feeding program for Foster chicks" was an instrumental part of the success of the whole foster parents project.

Recommendations:

1. Place macaw foster chick in receiver nest when age ranges from 20 days to 75 days old
2. Use macaw foster parents WITH previous breeding experience
3. Calibrate foster brood size using optimal brood size of the species in the area and brood size of current breeding season
4. Match foster siblings in same developmental stage
5. Provide supplemental food after relocation of foster chick, once per day for at least one week
6. Monitor heath status of foster chick to avoid disease exposure to foster chicks/parents

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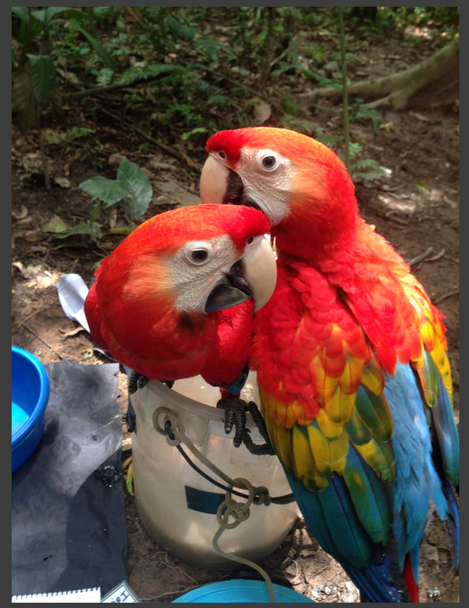
Main discovery:
100% of translocated chicks were successfully accepted by wild foster parents & 93% fledge successfully (N=15 chicks, 2 breeding seasons)



Picture 9 . Above: Second chick from a double brood with age difference of 6 days that would have starved without our intervention. Right: same second chick with its foster sibling, both almost ready to fledge.

The management technique of using wild macaws as foster parents was categorically successful for four reasons:

1. All foster chicks were accepted by new parents → NO chick rejection
2. Foster chicks were fed at rates similar to resident chicks
3. Foster chicks' growth was similar to wild chicks' growth
4. Over 90% foster chicks fledged

In the wild, macaw chicks that starve are "wasted" from a conservation perspective. This research shows that it is possible to use these chicks to increase overall reproductive success.

Acknowledgments Thanks to Mark Moore, Dr. Maria Belen Aguirre, Dr. Sharman Hoppes, Liz Villanueva Paipay, Gustavo Martinez, Shannan Courtenay and the whole BS 2017 & BS 2018 "guacamayeros" team at TRC. To Rony Garcia, WCS Guatemala. Special thanks to Mandy Lu Brightsmith. Dedicated to CEIBA.

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CONCLUSIONS

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