Scarlet Macaw Conservation in the Chiquibul Forest

Nesting Ecology and In-situ Species Management

REPORT 2024

FCD

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INTRODUCTION

The majestic Neotropical Scarlet Macaw is native to the humid evergreen forests of the neotropics in Central and South America. The *Ara macao* is the most widely distributed of the 17 extant macaw species; distributed from Mexico to Brazil (Wiedenfeld 1994) with the greatest concentration in the Amazon. The Scarlet Macaw is identified under two subspecies, *Ara macao cyanoptera*, which ranges from southern Mexico to southeast Nicaragua (including Belize), and *A. macao macao*, which has a range from Nicaragua to Brazil and Bolivia, (Estrada 2014). The northern subspecies, *A. macao cyanoptera* is considered in danger of extinction in Belize and in other indigenous range; even though the International Union for Conservation of Nature (IUCN) classifies the scarlet macaw of "least concern", it is evident that the Scarlet Macaw is suffering substantial decline in settled and developing areas (Low n.d.).

In Belize, the concentration of sightings at various locations along, the riparian areas of the Chiquibul Forest; Upper Macal River and tributaries, Raspaculo Branch and tributaries, Monkey Tail Branch, and Chiquibul River reflects the availability of food during the dry season until the end of May, when post-breeding flocking takes place (Stafford et al. 2001). Furthermore, their local range is restricted to the Chiquibul/Maya Mountain Massif, with an estimated population of 300-350 individuals. Evidently, the future of the Scarlet Macaw in Belize is far from secure, and a long-term monitoring and protection protocol remains essential to develop a sound strategy for the conservation of this endangered species.

In 2024, Friends for Conservation and Development was able to systematically document Scarlet Macaw breeding and monitored nests against poaching of chicks, an effort that the organization has undertaken since 2011. The objectives of this report are to: (i) present the findings of the 2024 scarlet macaw breeding season (ii) and summarize the in-situ conservation strategies implemented to increase nest success and reduce rate of poaching.

METHODOLOGY

Bio-Monitoring

1. Active search for potential nests began at the onset of the breeding season, around March and continued throughout the breeding season, to late August. After a potential nest was discovered, GPS coordinates were recorded. The FCD Research Field

Assistants, actively engaged in Biomonitoring of scarlet macaw nests that concentrate along the Macal and Raspaculo riparian forests.

2. Through biomonitoring efforts, if an adult was observed inside the nest cavity for at least a week, the tree was climbed using single-rope-ascending technique and inspected to verify nest status.
3. Nests that were regarded as "Potential nests" were regarded active until confirmation that a breeding pair had laid eggs.
4. Once eggs hatched, the nest tree was climbed every 5-7 days and recorded the chicks' developmental stage. Nest monitoring continued until chicks fledged or nest failed.
5. Biomonitoring of the Scarlet Macaw active nests was assisted by Citizen Scientists that volunteered throughout the program.

In-Situ Laboratory

1. In consultation, and with prior approval, from the Forest Department, Scarlet Macaw chicks that were in nests considered being at high risk of being poached or dying of natural causes were extracted and reared at an in-situ field laboratory.
2. Feeding and Rearing of chick was carried out by trained staff to increase rate of success and to facilitate the soft release and integration of laboratory reared chicks into the wild.
3. Following the protocols established on the Hand-Book, developed by Friends for Conservation and Development and the Belize Wildlife Referral Clinic, potential fostering nests were identified for five of the chicks that were originally extracted at a young age.
4. After fostering was done, observation was maintained for 24-48 hours to ensure proper acceptance by the foster parents.

Figure 1*: Picture Showing Scarlet Macaws in their natural nest during biomonitoring*

Figure 2: *Research Staff climbing the quamwood trees during biomonitoring of the Scarlet Macaw nesting ecology*

RESULTS AND DISCUSSION

For the 2024 Scarlet Macaw Breeding season, a total of 21 active nests were systematically monitored along the Macal and Raspaculo River. While Russell (1964) had previously described Scarlet Macaw populations in Belize to be frequenting the uninhabited headwaters of many of the larger streams in the central part of British Honduras (now Belize), it was until 1991, when Mallory, described the Raspaculo River as the main habitat. Mallory (1993) described the overflight pattern as east/west axis and concluded that there was a high probability that the species migrated over the Maya Mountains from the Raspaculo River area to the Cockscomb Basin. The Raspaculo River has remained the main nesting grounds for the Scarlet Macaws, with 90.5% of the monitored nests in 2024 occurring in this branch. Scarlet Macaws are now understood to be seasonal elevational migrants following a seasonal pattern of fruit abundance. Annually, some macaws fly from the high-elevation region of Chiquibul to the low-elevation Maya Mountain foothills (and especially Red Bank), and then return to the Chiquibul (McReynolds 2012). The Red Bank area, in southern Belize now remains as the most important feeding ground for the Scarlet Macaws.

The species nests in hollows of emergent trees of *Schizolobium parahybum*, locally known as Quamwood. A Scarlet Macaw pair usually lay 2–4 eggs asynchronously, the incubation period is 26-28 days, and the chicks fledge around 86 ± 4 days post hatching (Forshaw 1989). In the Chiquibul, for the 2024 nesting season a total of 57 eggs were laid (*see figure 2*), out of which 37 eggs hatched, which is equivalent to 64.9% hatching rate. The average hatching rate for 13 years of data (2012-2024) recovered is 54.4%. These hatching rates are somewhat similar to the hatching success described by (Britt et al. 2010) where hatching rate was described at 63% in Guatemala and 59.0% in Belize. The number of eggs laid was highest in 2024, since monitoring started in 2012 while the hatching rate was the second highest since 2016, where there was a 77.8% hatching rate. There are a number of biotic and non-biotic factors that affect the hatching rate of Scarlet Macaws, including predation, and temperature. Studies have also shown that height of the cavity entrance from the ground and presence of tree crown connectivity have a negative effect on nest success.

The average clutch size per nest was 2.7 eggs (Min = 1, Max = 5), while the average brood size was 1.7 chicks (Min = 0; Max = 3) per nest. Out of the 37 eggs that hatched, only a total of 19 chicks fledged from natural cavities along the Raspaculo and Macal rivers which is equivalent to 51.35% fledging rate. A total of 9 chicks (21.62%) fledged from the In-Situ laboratory. The average number of fledglings per nest was 1.72 (Min = 0; Max = 2). A total of 11 Scarlet Macaw nests (52.38%) produced natural fledglings. A total of 5 nests (23.81%) did not produce any naturally occurring fledging because chicks were extracted to be hand reared at the Las Cuevas Research Station's In-Situ Laboratory, while 5 other nests (23.81%) had natural nest failure. There was no incident of poaching in the monitored areas (*figure 4*). However, in the past, evidence from ranger-based activities indicated that poaching of Macaw chicks did occur in Chiquibul even when

poaching was not documented in the monitored areas; perhaps in other distant breeding grounds which, unfortunately are not bio-monitored due to limited personnel.

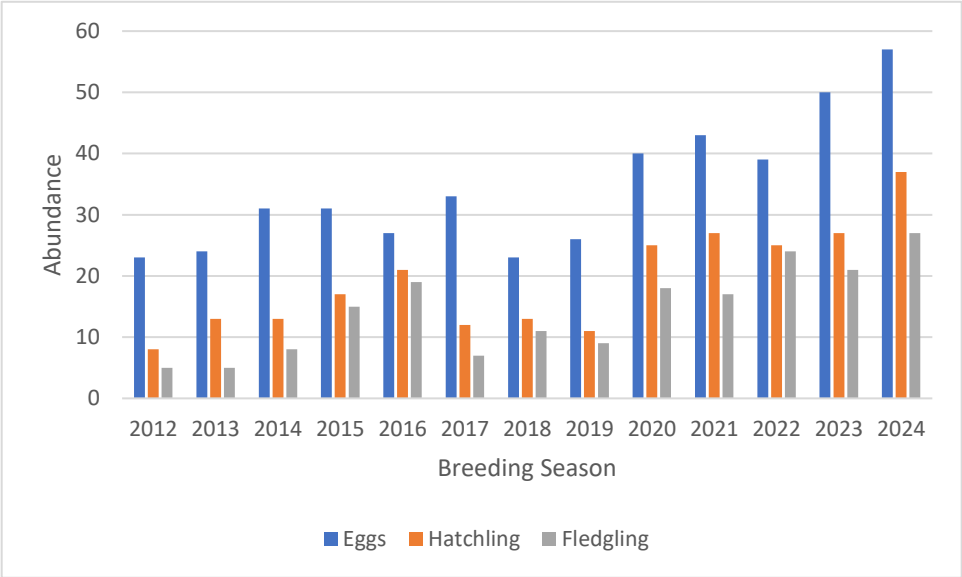

Figure 3: *Dynamic of Scarlet Macaw nest monitored during the 2012 to 2024 breeding seasons in the Chiquibul Forest.*

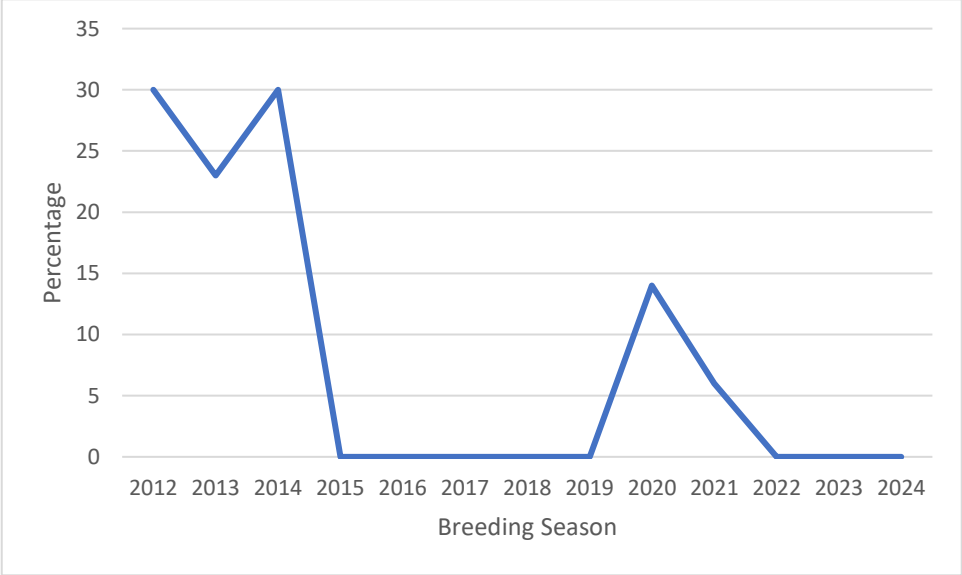

Figure 4*: Percentage of poached scarlet macaw nests which were being monitored by breeding season (2012-2024) in the Chiquibul Forest. No Poaching reported in 2022 - 2024.*

In-situ laboratory rearing of at-risk scarlet macaw chicks

While the goal of the in-situ laboratory is to increase the scarlet macaw population size of the Chiquibul Forest, the hand rearing of chicks is the last management step for population management. Following the standardized handbook and protocol for the in-situ management of at-risk scarlet macaw chicks, 14 chicks were extracted to the In-Situ Laboratory at Las Cuevas Research Station during the 2024 nesting season. Four of the Scarlet Macaw chicks (Chick ID # 7, #14, #13 and #8) were chicks that were rescued due to structural failure in which their nests broke-off, falling to the ground. The quamwood trees can tolerate mild droughts and moist soils, with good drainage and medium to heavy texture (Acevedo-Rodríguez & Strong 2012). The dry season was extended in 2024, which could have caused an increase in the number of structural failures of the nests. Chick #7 and #8 were aged 54 and 51 respectfully when rescued and transferred to the in-situ facilities, while Chick #14 and #13 were 80 and 79 days old respectively when transferred. The other chicks were at risk of either being poached or of starving to death. Parents feeding chicks favors the first chick, less to the second one, and pretty much starve the third and fourth chicks in the brood. Chick starvation due to brood reduction and chick starvation is the leading cause of chick mortality: (1) 27% of all second hatched chicks starve, and (2) all third and fourth hatched chicks starve (Vigo 2020). A total of 4 chicks were extracted because of the risk of starving to death. These chicks were extracted at age 2-14 days old, which significantly increases the chance of human imprinting and which also highlights the importance of following all the indicted protocols to reduce this risk.

Measuring and monitoring body weight is important as an indicator of proper growth of scarlet macaw chicks in the laboratory. Studying avian growth can provide insight in developmental tradeoffs, offspring size, reproductive output and potential conservation actions. Daily weight gain was recorded daily before the first feeding of the day. All chicks showed the typical hump-shape growth curve. All chicks peaked weight gain around 50 days of age, followed by a maintained weight with an eventual decline past the age of 75 days until fledging. It should be considered that chicks fledge at only 81% of adult body mass, so it is highly likely that they continue to gain body mass post fledging as has been found for most parrots (Vigo et al. 2011). As with previous experience, the younger the chicks when extracted the highest their weight gain and the older the extracted chick, the lower the gained weight while in the in-situ laboratory (Figure 5).

	Age When Transferred to Lab	Age When Transf. to Aviary/Swapped	Age at Release
Chick 1	14	90	142
Chick 2	6	63	Fostered
Chick 3	2	59	Swapped
Chick 4	13	54	Swapped
Chick 5	27	68	Swapped
Chick 6	25	66	Swapped
Chick 7	54	78	130
Chick 8	51	71	123
Chick 9	44	67	119
Chick 10	42	65	117
Chick 11	47	69	121
Chick 12	42	65	117
Chick 13	79	81	133
Chick 14	80	82	134

Table 1: *Estimated age of scarlet macaw chicks in days when each was brought to the field laboratory, transferred to aviary and on soft release date.*

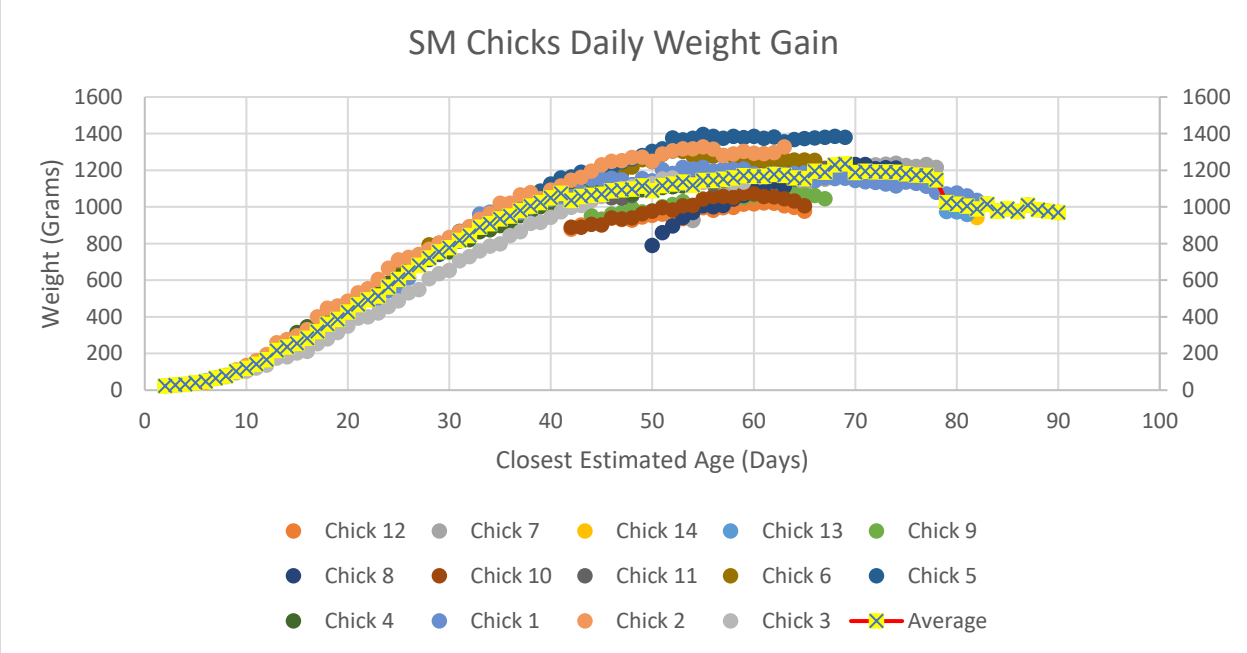

Figure 5: *Weight in grams by age of hand reared scarlet macaw chicks at the in-situ laboratory.*

With the need to extract chicks at a young age, and following studies done in Guatemala, FCD has been successful in the process of fostering/swapping. This process involves the removal of the third and fourth chicks (in some occasions) from their nests and inserting them into the nest of a different set of macaw parents that would be available to care for them, either because they lost their own chicks to predation, poachers, or natural factors or because their chicks were already grown enough to need less care. The use of foster parents in avian population management is a technique with great potential to aid in the recovery of highly endangered species in the wild (Cade & Temple 1995). Foster parenting, the use of breeding pairs to raise young that were not part of their initial broods, is a well-known aviculturist technique that has been intensively used in captive breeding and reintroduction programs over the last decades and also in conservation captive breeding programs to increase reproduction (Cade & Temple 1995).

During the 2024 breeding, season one chick (ID #2) went through the fostering program where it was introduced to a "single chick" nest at age 63. Four other chicks (Chick ID 6, 5, 4 and 3) went through the swapping program where they, initially at the lab, were swapped with wild chicks at age 66, 68, 54 and 59 respectively. The wild chicks were about the same age and transferred to the lab to continue their development through the In-Situ management. The protocols indicate that chicks are to be left in the nest to be reared by parents if nest is constantly guarded or is at low risk being poached. If this is not possible, chicks are extracted from their natural cavity and inserted in a foster nest if available to be reared by foster parents and fledge naturally. If foster nests are not available, chicks are hand reared at the laboratory, and swapped. If no chick with similar age is available for swapping, then the chicks continue the hand rearing and are eventually soft released, integrating into the wild population.

Potential foster nests need to have the following characteristics for the process to have a high success probability: 1) foster nest is guarded or located in a low poaching risk area, 2) foster nest has no more than one original chick, 3) chick in foster nest is of a similar age (plus or minus 3 days) as chick being introduced into nest, 4) no more than one foster chick is introduced into foster nest; on average scarlet macaws are only able to successfully rear 2 chicks, and 5) foster chick are monitored for 24 hours to confirm that foster parents are feeding chicks. If by any chance a foster chick is rejected, then chick needs to be extracted hand reared in the laboratory. All chicks that were fostered/swapped were accepted and subsequent biomonitoring confirmed their successful fledging.

A LANDSCAPE APPROACH: THE SOUTHERN MO'H WORKING GROUP

Scarlet macaws in Belize have shown a marked seasonal movement, thus highlighting the need not only to conserve and manage the critical nesting habitat in the Chiquibul forest, but also to conserve critical foraging habitat in the Red Bank area, which provides complementary resources. In Southern Belize, deforestation and wildlife hunting has been observed as the main

threats affecting the Scarlet Macaw. The removal of trees caused by agriculture expansion, over harvesting of the natural resources and careless wildfires lead to habitat destruction and loss of food source. Poaching or hunting of this species for pet trade, body parts or sports-killing places additional burden to the already threatened Scarlet Macaw population.

Community-based conservation (CBC), where local communities play a pivotal role in biodiversity conservation has greater impact over the long term, is flexible enough to be used in communities all year round, it is low-cost, and it is empowering to the local people. Other benefits of CBC include increased eco-tourism, which usually directly increases the income of local residents and increases the connection to the land for the community. This will generate environmental stewardship and give the communities a sense of pride and ownership and give them more of a stake in the protection of the land.

***Figure 6**: Showing members of the Southern Mo'h Working Group, from left side; Ms. Victoria Chi, Forest Department, Mr. Saul Cruz, National Biodiversity Office, Mr. Rafael Manzanero, Friends for Conservation and Development, Mr. Celso Sho, Red Bank Tour Guide, and Mr. Rojelio Sub, Red Bank Tour Guide.*

It was understood that Scarlet Macaw protection could benefit by having the support and participation of the local community. In January 2024, FCD along with the Belize Forest Department and the National Biodiversity Office met with leaders and community members of Red Bank to discuss the possibility of establishing a working group in Southern Belize. The working group consists of local village leaders, tour guides, business owner, teachers and community members of Red Bank. In June 2024, the group was renamed and recognized as the

"Southern Mo'h Working Group" (Scarlet Macaws are called Mo'h in Mopan Maya.) The working group functions are to:

- Advocate for protection of macaws
- Supporting mechanism for community outreach
- Assisting/guidance of field duties
- Monitoring and evaluating conservation actions
- Promoting conservation values among children/youth
- Encouraging/organizing reforestation activities at the community level
- Linking/networking for exploring financial opportunities ref macaw conservation
- Assisting in developing of action plans
- Provide status report on macaws of southern region

Members of the Southern Mo'h Working Group acknowledge that there is a need to increase knowledge and awareness on the importance of the Scarlet Macaw species towards communities and the forests along with methods to protect this species. In response to this, FCD contracted a part time Community Outreach Coordinator in August 2024.

SCARLET MACAW VETERINARY CARE

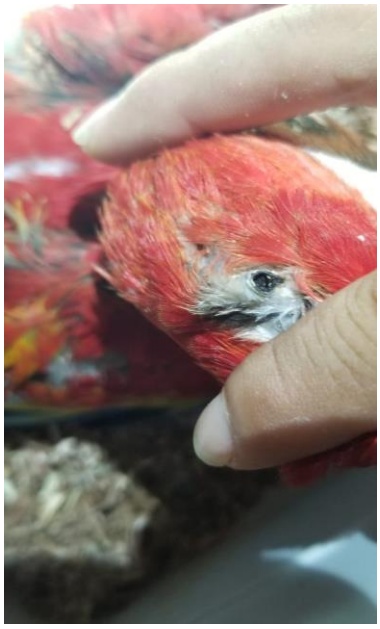

Figure 7: *Showing a chick at the In-Situ laboratory with botfly (Oestridae sp.) larva inside the flesh at the time of transfer from the natural nest to the in-situ facilities.*

Veterinary care is an essential component of the scarlet macaw conservation and management program carried out in the Chiquibul Forest. The service was generously provided by veterinarian Dr. Isabelle Paquet-Durand, from the Belize Wildlife and Referral Clinic (BWRC). A total of three general health checks were conducted on chicks that were extracted and transferred to the In-Situ Laboratory at Las Cuevas Research Station. Examined chicks were healthy except for some birds having mites and botflies. One of the extracted chicks had up to 18 botflies that were all treated and removed. Avid (R) Friendchip-mini micro-chip (Avid micro-chips were donated by BWRC) were implanted on 12 scarlet macaw chicks from the In-situ Laboratory. Hand reared chicks were frequently evaluated for general health and body conditions plus daily records of chick behavior were maintained. A general health check was conducted on the hand reared chicks before their soft release. Two of the chicks that were rescued due to nest structure failure had to be extracted to the BWRC facilities for further examination including X-rays and close observations. One of the chicks, labelled Chick #7 had a broken vertebra but no intervention was deemed necessary and both chicks were transferred back to the In-Situ Laboratory. Unfortunately, one of these chicks later died from a separate injury.

RECOMMENDATIONS

The 2024 Scarlet Macaw nesting season was categorically successful, with 28 chicks successfully fledging and integrating to the wild population of Scarlet Macaws but like any effort there are lessons learnt and recommendations detailed below:

- Obtain a long-term management agreement with the Belize Forest Department for ongoing biomonitoring of macaw nests and In-situ Laboratory efforts.
- Obtain access through the Belize Forest Department, the National Biodiversity Office and Bulridge Ltd to gated tracks for the IWT Rangers to conduct antipoaching activities.
- Continue biomonitoring of active scarlet macaw nests in the Macal and Raspaculo Rivers, with possible expansion upstream from the Raspaculo River and extraction of chicks from high at-risk areas where evidence indicates that poaching occurs.
- It is essential to improve on the required natural history information about the development of chicks and to conduct proper management interventions if necessary, such as transfer of chick to foster nests to reduce risk of poaching.
- Exchange with other organizations in Mexico, Costa Rica and Guatemala, as a learning experience, is recommended to be able to better improve our efforts.
- Training for the research staff to include emergency stabilization, rehabilitation, enrichment and more focus on disease recognition and emergency response in the latent period of the In-Situ processes, as well as release and post release period, including individual recognition techniques like banding, and behavioral observation.

- Continue with the enhancement process of natural cavity formation to increase nesting cavity availability to breeding macaws. The team usually engages in potential nest clean-ups, immediately after the end of a season, in which they clean a tree with a cavity, which has the potential of becoming an active nest, from all vines and debris. This has resulted in positive results.
- Consolidate a robust community conservation effort for scarlet macaws in Southern Belize and advocate for creation of a special wildlife conservation area by Red Bank.

REFERENCES

- Acevedo-Rodríguez P, Strong MT, 2012. Catalogue of the Seed Plants of the West Indies. Smithsonian Contributions to Botany, 98:1192 pp. Washington DC, USA: Smithsonian Institution. http://botany.si.edu/Antilles/WestIndies/catalog.htm
- Arrevalo, B. 2021. Protocols for the In-situ management of at-risk scarlet macaw chicks in the Chiquibul Forest, Belize. Friends for Conservation and Development. San Jose Succotz, Cayo. Belize.
- Britt, C. R., García Anleu, R., & Desmond, M. J. (2014). Nest survival of a long-lived psittacid: Scarlet Macaws (Ara macao cyanoptera) in the Maya Biosphere Reserve of Guatemala and Chiquibul Forest of Belize. *The Condor: Ornithological Applications*, *116*(2), 265-276
- Cade, T. J., & Temple, S. A. (1995). Management of threatened bird species: evaluation of the hands-on approach. Ibis, 137, S161-S172.
- Estrada, A. (2014). Reintroduction of the scarlet macaw (Ara macao cyanoptera) in the tropical rainforests of Palenque, Mexico: project design and first year progress. *Tropical Conservation Science*, *7*(3), 342-364.
- Forshaw, J. M. (1989). Parrots of the world Melbourne. Melbourne, Australia: Landsdowne Editions/
- García-Anleu, R., Ponce-Santizo, G., Gulick, S., Boyd, J., Brightsmith, D. J., & McNab, R. B. (2017). Predation on scarlet macaw (Ara macao cyanoptera) chicks by collared forest falcons (Micrastur semitorquatus) in the Maya biosphere reserve, Guatemala. *Sociedad de Ornitología Tropical*, *28*, 213-217.
- George, R. J., Plog, S., Watson, A. S., Schmidt, K. L., Culleton, B. J., Harper, T. K., ... & Kennett, D. J. (2018). Archaeogenomic evidence from the southwestern US points to a pre-Hispanic scarlet macaw breeding colony. *Proceedings of the National Academy of Sciences*, *115*(35), 8740-8745.
- Hess, L. (2015). A new look at the endangered species act and its effects on genetic diversity. *Journal of Avian Medicine and Surgery*, *29*(4), 354-359.
- Low, R. The World Parrot Trust. *AFA Watchbird*, *19*(4), 45-46.

- Mallory E.P. 1991. Survey of Birds and Their Habitats, in A.D.F. Rogers & D.A. Sutton (Eds.), Report of the Joint Services Scientific Expedition to the Upper Raspaculo, Maya Mountains, Belize. London, UK: The Natural History Museum.
- Mallory E.P. 1993. Scarlet Macaws in the Upper Raspaculo River Basin, Maya Mountains, Belize. Annex G, Ornithology, in A.D.F. Rogers & D.A. Sutton (Eds.), Report of the Joint Services Scientific Expedition to the Upper Raspaculo, Maya Mountains, Belize. London, UK: The Natural History Museum.
- McReynolds, M. S. (2012). *Patterns of seasonal variation in diet, abundance, and movement of the Scarlet Macaw (Ara macao) in southern Belize*. Antioch New England Graduate School.
- Newman, G., Graham, J., Crall, A., & Laituri, M. (2011). The art and science of multi-scale citizen science support. *Ecological Informatics*, *6*(3-4), 217-227.
- Nycander, E., Blanco, D. H., Holle, K. M., Campo, A. D., Munn, C. A., Moscoso, J. I., et al. (1995). Manu and Tambopata: Nesting success and techniques for increasing reproduction in wild macaws in southeastern Peru. In B. L. S. J. Abramson, & J. B. Thomsen (Eds.), The large macaws: Their care, breeding and conservation (pp. 423–443). Fort Bragg: Raintree Publications.
- Olah, G., Vigo, G., Heinsohn, R., & Brightsmith, D. J. (2014). Nest site selection and efficacy of artificial nests for breeding success of Scarlet Macaws Ara macao macao in lowland Peru. *Journal for Nature Conservation*, *22*(2), 176-185.
- Renton, K. (1998). Ecology and conservation of the Scarlet Macaw in Belize. *Forestry Department, Conservation Division, Ministry of Natural Resources, Belmopan, Belize*, 4-11.
- Russell S.M. 1964. A Distributional Study of the Birds of British Honduras, American Ornithological Union.
- Stafford, M. P., & Sanders, M. L. (2001). Preliminary Report on the Scientific and Biodiversity Value of the Macal and Raspaculo Catchment, Belize.
- Vigo Trauco, G. (2020). *Scarlet Macaw nesting ecology and behavior: Implications for conservation management* (Doctoral dissertation).
- Vigo, G., Williams, M., & Brightsmith, D. J. (2011). Growth of Scarlet Macaw (Ara macao) chicks in southeastern Peru. *Neotropical Ornithology*, *22*, 143-153.
- Vigo-Trauco, G., Garcia-Anleu, R., & Brightsmith, D. J. (2021). Increasing survival of wild macaw chicks using foster parents and supplemental feeding. *Diversity*, *13*(3), 121.
- Wiedenfeld, D. A. (1994). A new subspecies of Scarlet Macaw and its status and conservation. *Ornitologia Neotropical*, *5*, 99-104.