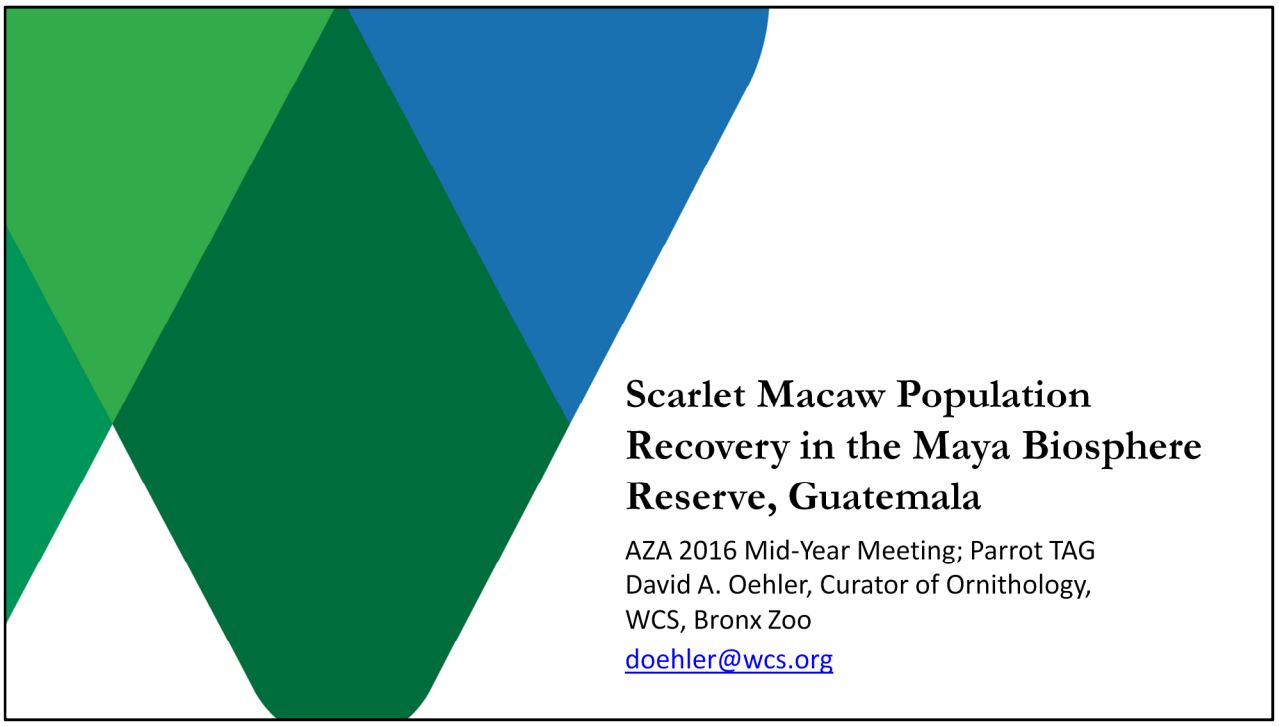
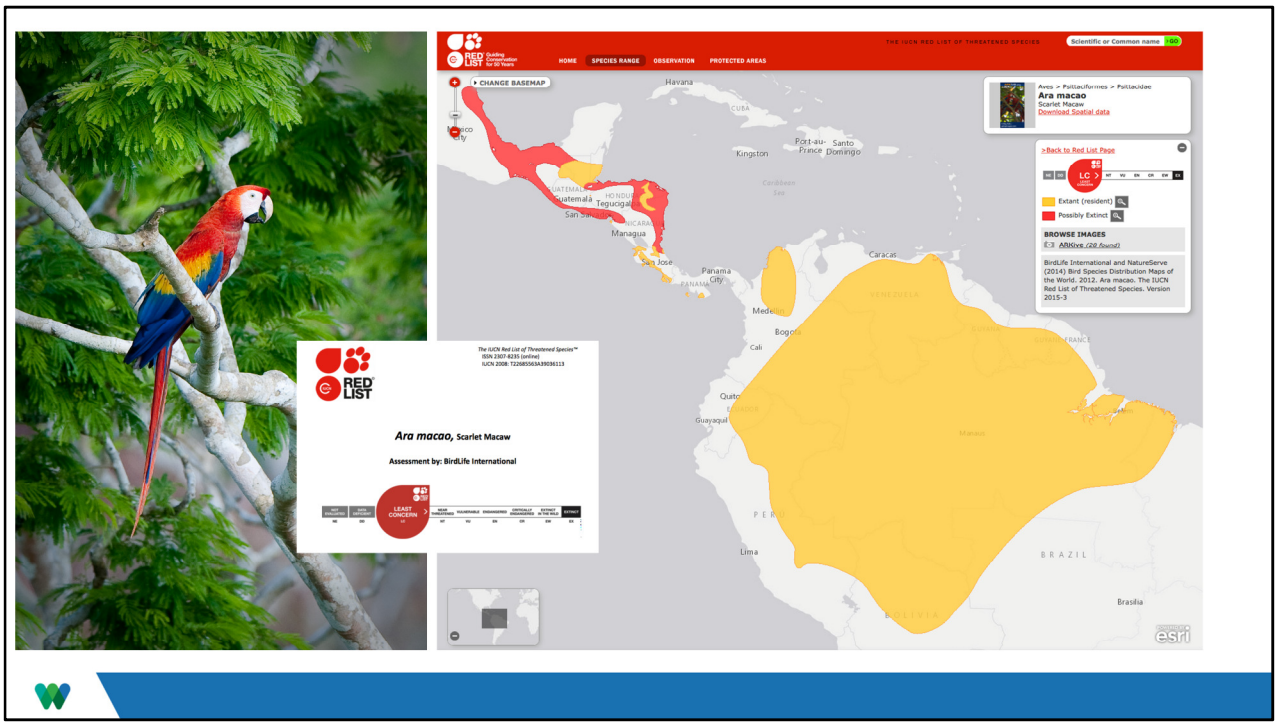
The Scarlet Macaw Population Recovery in the Maya Biosphere Reserve, Guatemala is a team effort, involving the Wildlife Conservation Society (WCS) offices in New York and Guetemala. Rony García Anleu and Gabriela Ponce Santizo function as the day-to-day scientific supervisors of the project, coordinating the field operations and ensuring that the staff and institutions collaborating in the project are duly involved. They are in charge of the financial and programmatic integration of associated projects in the hope of developing a multi-faceted approach to the conservation of the Scarlet Macaws, *Ara macao*, in Guatemala. They also compile and process field data, and collaborate in the development of the workshops, laboratory equipment setup, and training. Melvin Mérida functions as the day-to-day veterinary supervisor for the project, coordinating the field technician's activities and field data records. David A. Oehler and Roan Balas McNab are coordinating general project design and strategy and bring the project to the attention of new donors and decision makers to ensure effective conservation actions.

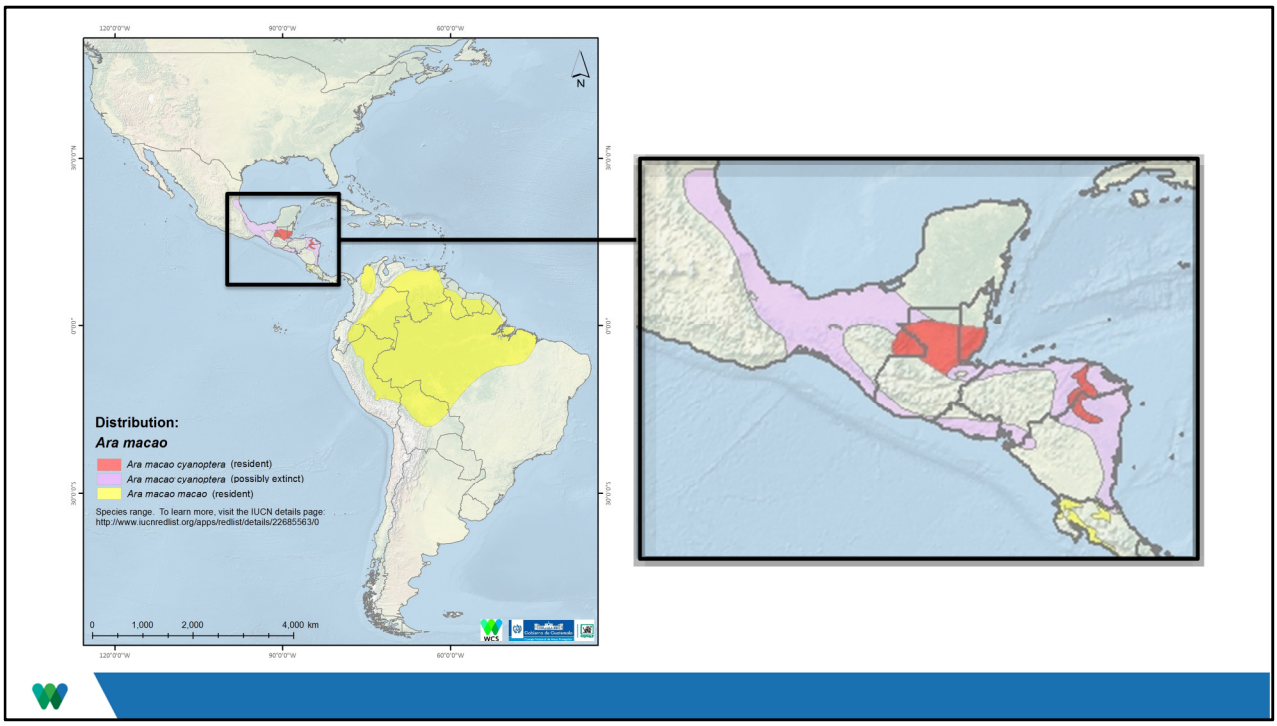


The scarlet macaw is one of the 16 species of macaw currently in existence and distributed over the tropical rain-forest region of the Americas, the neotropical region. The third largest of these species, it is generally observed in pairs or flying in family groups. It is a species comprising two subspecies which have only recently been recognized. In general, little is known about its biology. This presentation is our means to provide AZA members with an opportunity to in the conservation and recovery of the scarlet macaw.



The emblematic scarlet macaw is the most widely distributed of all macaw species, helping it to remain classified as *Least Concern* in the IUCN Red List of Threatened Species. But the Mesoamerican subspecies, *A. m. cyanoptera,* is highly threatened by poaching and habitat loss. Experts estimate the current population of *A. m. cyanoptera* to be less than 1000 individuals distributed across southern Mexico, Belize, Guatemala, Honduras, and Nicaragua. The Wildlife Conservation Society (WCS) estimates that 250 individuals remain within the Maya Biosphere Reserve of Guatemala (MBR).

The scarlet macaw is listed in appendix I of CITES due to illegal trade in specimens captured in the wild and sold in particular on domestic markets, to habitat loss and to fragmentation of populations. This species is found exclusively in forests at water's edges, where the forest is evergreen at high levels and semi-deciduous at medium levels. It is found from sea level up to 600 m above sea level. Reported densities of 1 pair per square kilometer have been recorded. Its reproduction is slow, and the breeding season varies with the latitude. In the northern part of Central America (Guatemala and Belize) and in Mexico it breeds between January and July. In other parts of Central America (Costa Rica and Panama) it breeds from December to June and in South America (Venezuela, Peru, and Brazil) the breeding period may extend from November to June. The species requires large/tall trees, where they lay one or two eggs, inside cavities made in these living or dead trees by other birds or occasionally by themselves. The chicks hatch on average after 28 days of incubation and remain in the nest until the age of 120 to 137 days. Thus, they spend between three and four months in the nest. The parents feed them four to six times a day.



The scarlet macaw was once revered as an oracle of the sun in Central America. Today, the Mesoamerican *cyanoptera* subspecies is highly threatened by poaching and habitat loss. Experts estimate the current population of *A. m. cyanoptera* to be less than 1000 individuals distributed across southern Mexico, Belize, Guatemala, Honduras, and Nicaragua.

Threats in these specific areas are outlined below;

Belize: The destruction of the only nesting site of the scarlet macaw in the country was brought about by the “Macal River-Chalillo” hydroelectric development project; an additional occasional threat is capture for illegal trade and subsistence hunting, in addition to the fragmentation and isolation of wild populations.

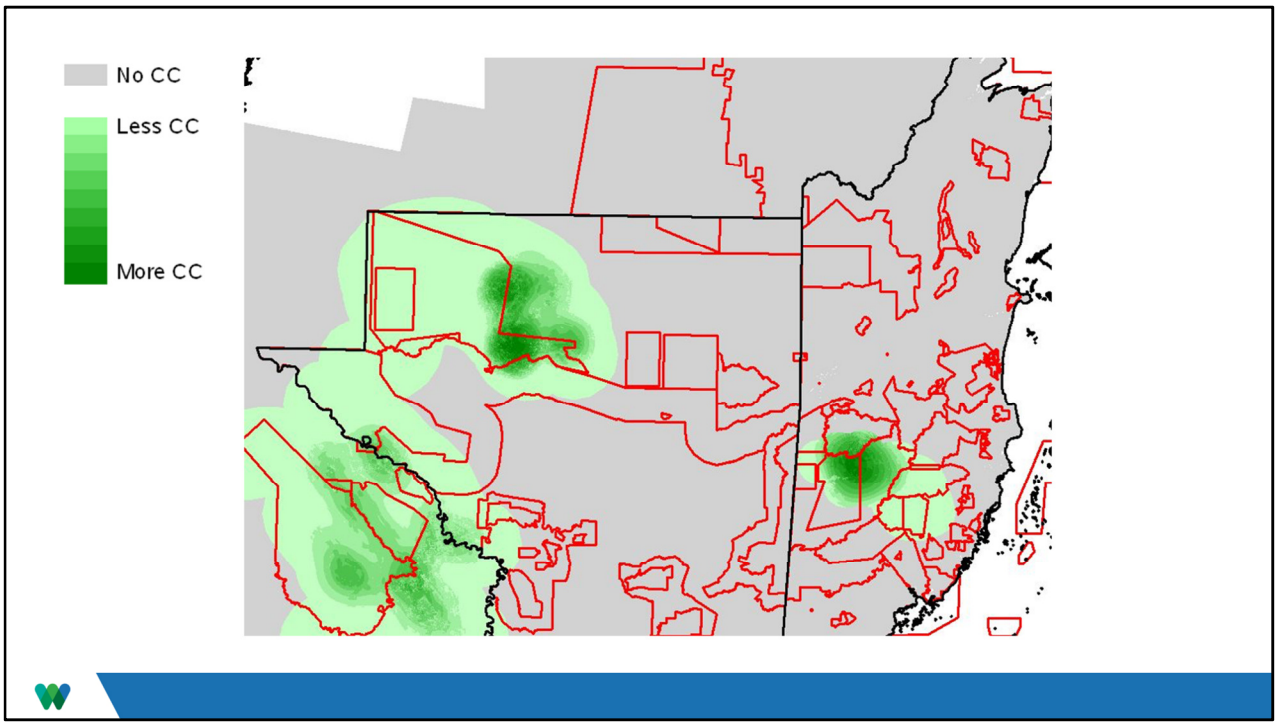
Costa Rica: the Illegal capture of specimens, destruction of nests, deforestation, and fragmentation of populations and habitat.

Guatemala: Destruction of nesting sites, capture for the illegal trade both on domestic and on international markets, fragmentation of populations and competition for nesting sites, with the scarlet macaws being displaced by from their nesting cavities by Africanized honey bees.

Honduras: the Illegal capture of specimens, destruction and fragmentation of habitat.

Mexico: Legal and illegal capture of wildlife specimens, fragmentation of populations and habitat. In the report on trade in parrots across the Texas-Mexico border (in the states of Nuevo León and Tamaulipas), it is noted that between 1990 and 1993 four scarlet macaws were confiscated. At the police station of Profepa, alone, in the State of Nuevo León, between 1997 and 2000 more than ten specimens of *Ara macao* were confiscated.

Nicaragua: Trade in the last specimens in the country, fragmentation of habitat and wild populations.



The Wildlife Conservation Society estimates that 250 individuals remain within the Maya Biosphere Reserve of Guatemala. The Reserve was created in 1990 to protect the largest area of tropical forest remaining in Central America. The biosphere reserve model, implemented by UNESCO, seeks to promote a balance between human activities and the biosphere by including sustainable economic development in conservation planning. With over 21,000km² the MBR is a bit larger than Yellowstone National Park, in the United States. WCS provides boots on the ground; implementation of field science, protection, and community-based conservation programs. We are succeeding and the scarlet macaw population is rebounding.

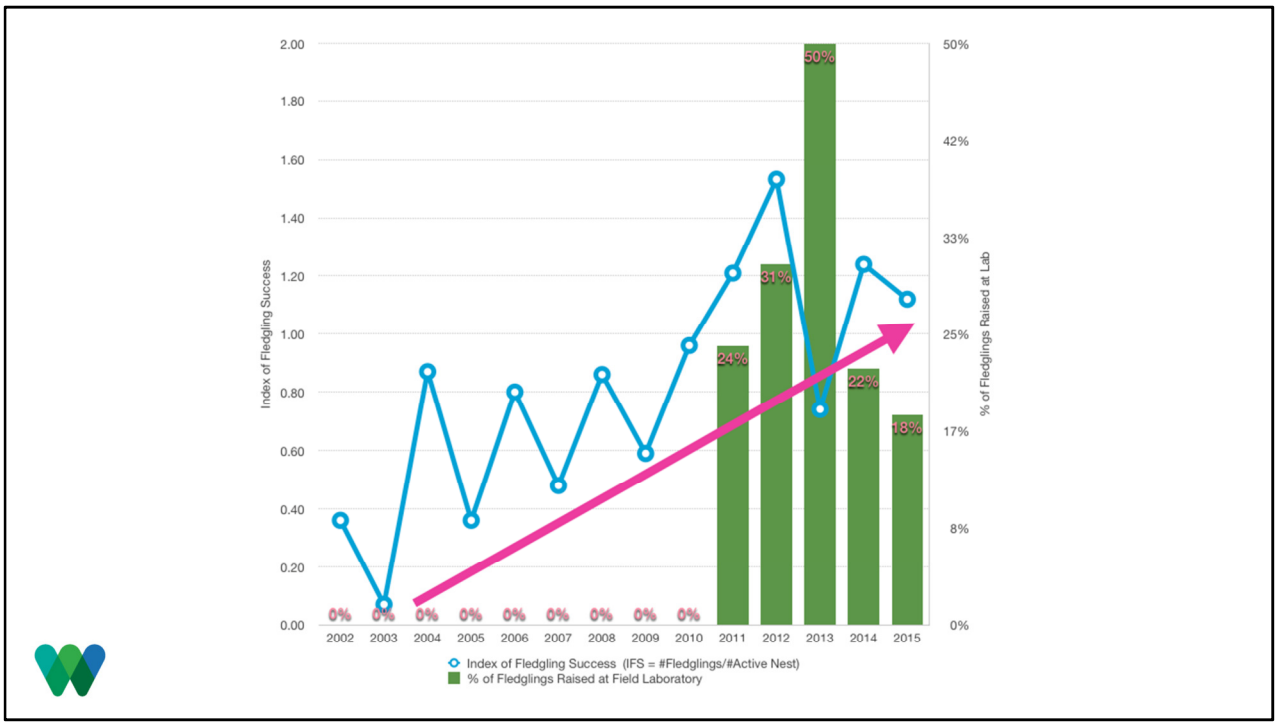
Until recently, the aforementioned threats were rapidly pushing this iconic species towards extinction in Guatemala. WCS intervened to reduce the frequency of macaw poaching, protect nesting sites from deforestation, fire and Africanized bee infestation, deploy double-chambered falcon-proof artificial nests and undertake systematic evaluations of macaw nesting success. They are also working on governance issues and prosecution of illegal land barons (deforestation and illegal incursions) which is showing positive results.

WCS intervened to reduce the frequency of macaw poaching (and incursions). The processes involved are biological research (field monitors) in place to detect threats and organize defenses, over-flights to monitor other activities and SMART patrols including WCS technicians.

Protect nesting sites from deforestation and fire is key.

The effort to prevent Africanized bee infestation through the use of double-chambered falcon-proof artificial nests is underway. In addition, focus on relocating the bees are critical. Efforts to “push” bees out of nest cavities are the first step, with new efforts to “pull” bees towards alternative boxes, using pheromones showing promising results.

We are undertaking systematic evaluations of macaw nesting success. Nests are monitored every 8-10 days, with egg, chick and juvenile numbers being recorded. An Index of Fledgling Success (IFS) is generated to provide quantitative metrics; ratio of a number of fledglings to the number of nests.

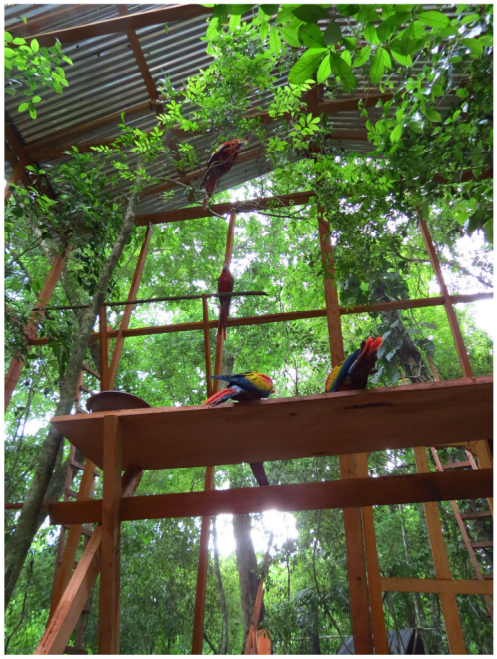


Since 2002, WCS has evaluated the impact of our scarlet macaw conservation interventions using an Index of Fledging Success – calculated as the number of successful fledglings per active nest monitored. Although initial efforts led to a significant increase in successful fledging, research suggested that additional interventions might accelerate the rate of population recovery. WCS thus began using aviculture techniques to maximize the production of macaws by enhancing the survival of eggs or chicks considered to be at risk in natural cavities.

Since 2013 WCS has been pulling 4th and 5th eggs laid within nesting cavities to hatch them within a solar-powered incubator at the site of El Peru, deep within Laguna del Tigre National Park.

We have also raised the third (and rarely) fourth chicks hatched in wild nests in the laboratory when they were unable to compete for food with their older siblings. Monitoring of nests has demonstrated that ≈99% mortality rates in the third and fourth chicks that hatch in a single nest. There were two events where a third chick survived to fledging.

Fledglings raised within our “jungle laboratory” face two potential destinies: The first is placement back within the nest of a foster pair of macaws that by coincidence have a single fledgling near the same age as the adoptive chick. This system has been demonstrated to be highly effective, yet the availability of foster parents that fit the bill varies considerably from year to year.



The second option consists of placing chicks within an *in-situ* flight cage where they strengthen their flying skills and learn to eat local fruits. Wild macaws often fly overhead, calling out loudly. The fledglings are eventually set free to join the wild population, and their progress is tracked with VHF radio collars for a number of months. In 2013, five of nine juveniles were tagged with VHF transmitters (Telanax TXE-311CP), although no results were obtained, due to the failure of these units. New equipment has been identified for use and our goal is to track 50% of all released birds, in the future.

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In the future, WCS will continue to improve the aviculture protocols employed in Guatemala, as well as improve the facilities of our jungle laboratory. Lessons learned will be shared to illuminate the path for partners in Belize (Friends for Conservation and Development), who have begun to replicate the WCS approach to restoring the macaw population of Belize, now estimated to be as low as 200 individuals. The carrying capacity is estimated to be 700 macaws in Maya Forest (Guatemala, Mexico, and Belize), so the ability to grow this population is a viable goal

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