WDA Latin America

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CONSERVATION AT THE FIELD

The scarlet macaw (*Ara macao*) program in Guatemala

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Although the scarlet macaw (*Ara macao*) ranges from northern Mesoamerica through Peru and Brazil, and is classified by the IUCN Red List of Threatened Species as of Least Concern, the iconic Mesoamerican sub-species (*A. m. cyanoptera*) is highly threatened. Poaching and habitat loss, largely driven by human-caused forest fires, cattle ranching, and the expansion of human settlements, have fragmented and reduced the total population of *A. m. cyanoptera* to less than 1,000 animals, distributed across southern Mexico, Belize, Guatemala, Honduras, and Nicaragua. The Wildlife Conservation Society (WCS) estimates that 250 scarlet macaws remain within Guatemala's Maya Biosphere Reserve (MBR).

The MBR is the largest protected area complex in Central America and constitutes the core of a trinational system of protected areas in Guatemala, Belize, and Mexico. Although the MBR remains a stronghold for scarlet macaws, habitat loss and poaching continue to threaten their survival in all its remaining Mesoamerican populations. WCS' interventions focus on the most important remaining nesting areas in Guatemala: the eastern section of Laguna del Tigre National Park and the Laguna del Tigre-Mirador Biological Corridor. These key macaw nesting sites are allocated on the western edge of the largest block of intact forest in the MBR. By conserving macaws and their habitat, we are also conserving the western flank of the trinational Maya Forest, the largest block of remaining tropical forest in Mesoamerica.

In 2008, WCS' Guatemala Program developed a National Scarlet Macaw Recovery Plan, which outlined potential aviculture interventions that could accelerate the rate of population recovery. WCS thus

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initiated efforts to maximize the natural reproduction of macaws by providing veterinary medical support for chicks in natural cavity nests considered to be at risk of fatality, including chicks facing heavy parasite loads, and the third and (rarely) fourth chicks hatched in the nest - usually in disadvantage to compete for food with their older siblings. In addition, to obtain the clinical profile (physical examination) of the chicks, the objective of this intervention was to determine the baseline health status of the scarlet macaw population in the western region of the RBM through hematological values, blood chemistry and serology of several infectious diseases.

Recently the project expanded to include the extraction of the third and fourth laid eggs from the nest cavities to artificially hatch them in incubators at a remote field camp in El Perú, in Laguna del Tigre National Park. The America Federation of Aviculture, Inc. generously provided equipment to improve the incubator system (batteries and transformers), which allowed the project to continue refining and testing two management options:

1. Replacement of chicks within foster nests with a single fledgling of approximately the same age as the adoptive chick
2. Placement of juveniles in an external flight cage for subsequent soft release into their wild habitat.

Over the last decade, WCS has developed an integrated program to reduce threats and increase scarlet macaw recruitment in the MBR, including:
• Extraction of the third and fourth eggs for incubation in a solar-powered incubator.
• Use of a solar-powered brooder
• Extraction of chicks found to be at risk in wild nests (i.e. presence of Africanized bees, falcon predation, and illnesses)
• Extraction of (low weight) 3rd and 4th chicks unable to compete for food with their siblings
• Placement of chicks back into foster wild nests, where viable.
• Release of hand-raised macaws back into the wild following acclimatization in an in situ flight cage.

In the last six years, the WCS Guatemala Program raised 71 macaw chicks; 44 rescued from nests at risk and 27 hatched from eggs incubated in the field laboratory by the incubation system (ran with solar energy and 12 VCD batteries). Of those, 27 chicks were placed in foster nests (with 100% fledging success), and 19 were moved into an in-situ flight cage. The remaining 25 chicks died of natural causes while still in the laboratory.

Our future goal is to continue our research on the health status of the scarlet macaw (i.e. intestinal parasites) and to improve the chick management practices in the field laboratory, in order to increase the population of red macaws in Guatemala.

Finally, we cordially invite students who want to do a 3-month internship (non-payable) and perform research with the scarlet macaw project, to send an email to Luis Fernando Guerra (lguerra@wc.org), for more information about our work in Guatemala.

Authors' Bio

Luis Fernando Guerra is a Guatemalan veterinarian, with a master in Wildlife Conservation and management by the Wildlife Conservation and Management Institute (ICOMVIS) of the Nacional University of Costa Rica (UNA). He currently works at the Wildlife Conservation Society - Guatemala Program as coordinator of the biological research department of conservation projects with the scarlet macaw and conflicts between ranchers and jaguars at the Mayan Biosphere Reserve in

Guatemala. His interests include One Health research approaches in protected areas of Petén, Guatemala. Rony García Anleu is a Guatemalan biologist with a Master of Science in Wildlife Management by the Faculty of Veterinary Medicine of the University of San Carlos de Guatemala. Working in the Maya Biosphere Reserve since 1998, and since 2002 with WCS. Its main interests are biological monitoring and the management and conservation of landscape species such as scarlet macaws, jaguars, tapirs, wild boar and white turtles. He is currently the Director of the Biological Research Department of WCS-Guatemala.

CONSERVATION PROYECTS

THE FOREST THAT PROTECTS YOU!

Lilian Silva Catenacci, DVM, PhD.
Brazil

"While education, prevention and early control of outbreaks may be the key to reducing the impact of epidemics and potential pandemics, especially in less developed countries, the world still remains positioned to respond, not to prevent[1]." This sentence was published by Kelly and collaborators in the beginning of this year, and it reflects the researchers' concern about the global scenario of emerging and reemerging diseases, such as influenza, Ebola, Chikungunya, Zika and Yellow-fever virus. However, it also serves to remind us that the health of humans, animals, and ecosystems are interconnected. All life on Earth is suffering the consequences of human behavior/attitudes. The fact is that "early detection and response to emerging pathogens in humans, and other animals, requires a coordinated, interdisciplinary, collaborative, cross-sectoral One Health approach at global, regional and local levels[2]".

We developed an example of a One Health Initiative in rural communities that live in or near natural protected areas of the Atlantic Forest, Brazil. Focusing on the impact of vector-borne diseases for wildlife and humans (e.g., Zika, Chikungunya, Dengue and Yellow-fever) and the conservation of biodiversity, we built networks among local and international health, conservation and educational professionals—always involving the local population. We have learned key elements for enhancing the networks in this area of Brazil. These elements included: (1) development of trust for strong collaborations and partnerships among local and international organizations, universities, and government agencies, including the health and

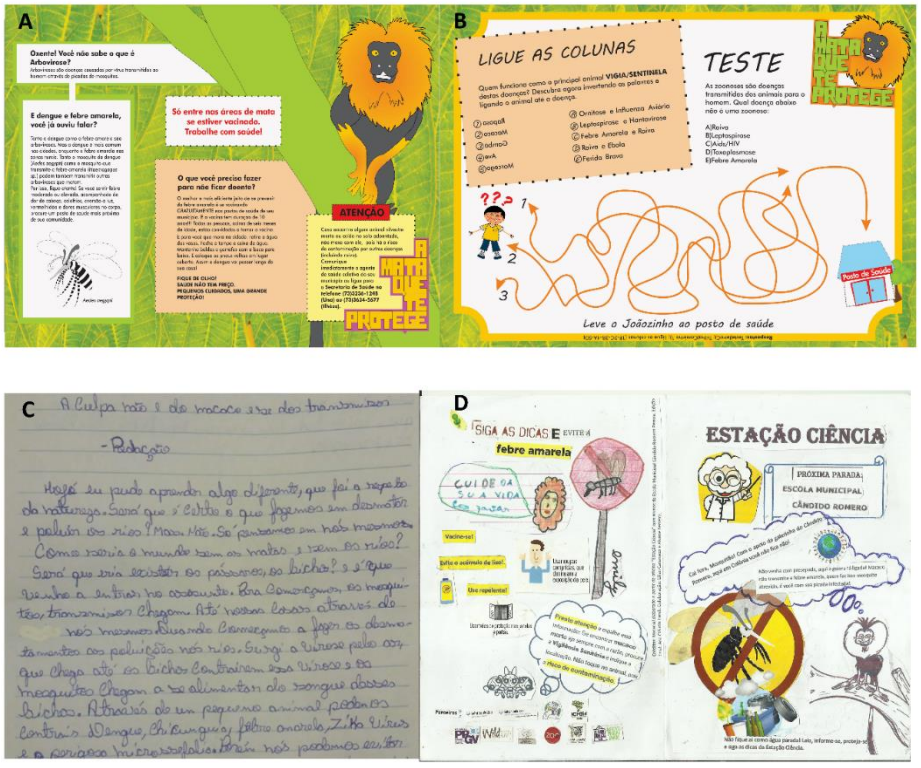

Figure 1. Educational material developed in Bahia, Brazil. (a, b) Work sheets activities distributed for the stakeholders; (c) student's writing after the "Science Station Day"; (d) brochure elaborated by the students to be distributed for the rural communities.

environmental services; (2) organization of meetings, workshops and training to empower local groups to assume leadership and sustain programs in the longer term; (3) promotion of entomological survey and biological material collection from free-living species; (4) interview and blood collection in people from the rural communities that live close to the place where the wild animals were sampled, and (5) organization of educational material for and with the stakeholders, including activities in the schools of the rural communities were all components of this successful One Health effort in this region.

The serological results from the wild animals suggested the viral circulation of several arbovirus, including dengue, yellow-fever and others; and we also found a high biodiversity of mosquitoes (potential vectors). Because of these results and using the network already created, the Health Services could conduct a sero-prevalence in 11 rural human communities from the area. Four arbovirus (antibodies) found in the human population were similar to those sampled from wild animals. The created network allowed us to share all the results with the stakeholders, including the Health and Environmental services. Strategies and actions to prevent higher prevalences of arbovirus in humans and animals, conservation of biodiversity, and methods for the prevention of outbreaks were conducted. Local campaigns, called "The forest that protects you" and the "Science Station Day" (see highlights thoughts above) were developed and flyers, word search puzzles and other educational materials were distributed. Activities in the rural schools culminated with material on preventive measures against arboviruses elaborated by the students, which were distributed to the communities.

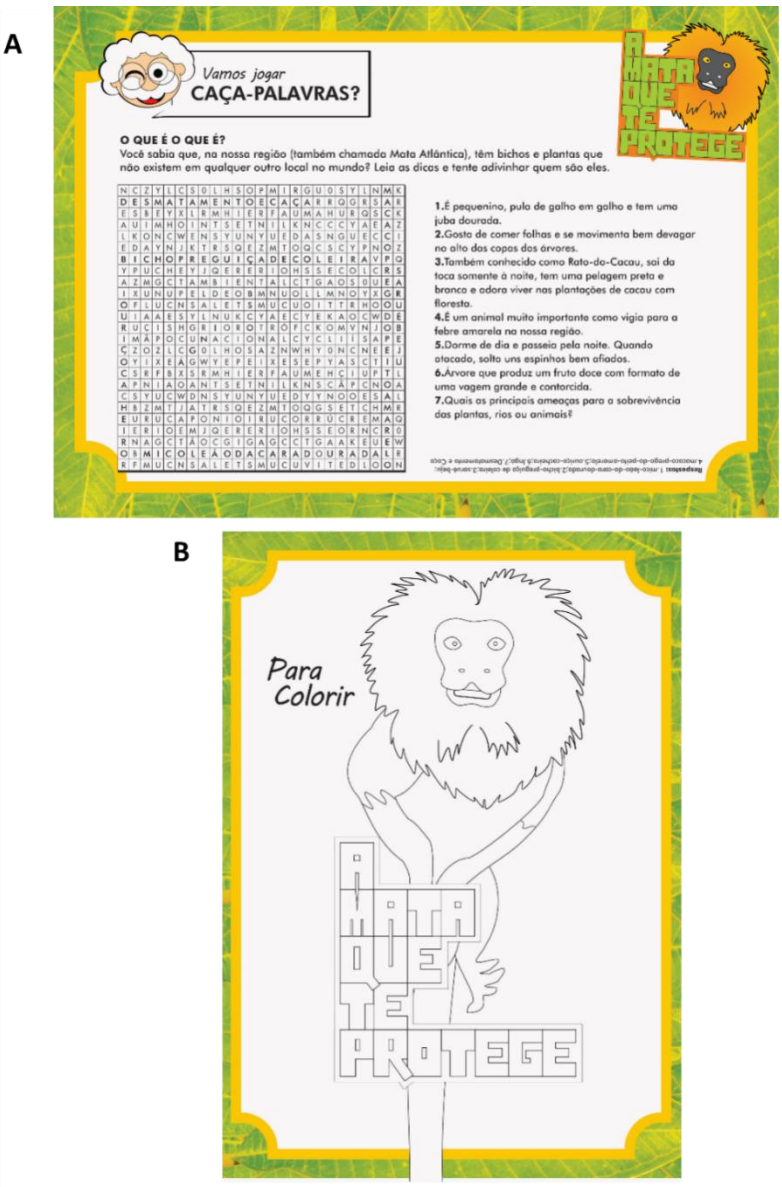

Figure 2. Educational material distributed for the stakeholders in Bahia Brazil. (A) Cross words; (B) Colourfull

We strongly believe the continuing education strategies with households, communities and institutions that focus on the adoption of effective habits and practices to prevent and to reduce the risk of transmission of emerging and reemerging diseases are critical to our success. More connections among researchers in the references laboratories and field

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teams are necessary and professionals with environmental education and public health are indispensable.

We also encourage both undergraduate, Master and PhD students as well mentors in their work with interdisciplinary team and including outreach education; which could minimize the distance between the university, communities and public policy.

Student's highlight thoughts written by school students from the Colônia de Una, in Bahia, Brazil, one day after the 'Station Science Day":

"If a monkey dies where you usually walk or where you live, it's because they already have this disease (yellow fever). Because they can't protect themselves from the mosquito bite, but you have to protect yourself by wearing long sleeves, paints and protecting your face." (GS, 7th grade)

"I understood that it can't deforest the forest, we have to protect ourselves from mosquitoes and the best thing to prevent yellow fever is taking the vaccine." (BSS, 6th grade)

"Let's take care of animals, because animals take care of nature. And we will take care of nature because it will avoid animals from entering the cities, including the Haemagogus (yellow fever mosquito). "

"Today I learned something different, which was to respect nature. Is it okay what we have been doing: deforesting and polluting the rivers? No, and we only think of ourselves. Could the world sustain without rivers and forests? Without birds and other animals? To begin with, mosquitoes would start to arrive in our homes. A small animal (the mosquito), can transmit Dengue, Chikungunya, Yellow Fever and Zika virus and we can have the dangerous microencephaly. But we can avoid it. And how? By not pollute rivers and applying preventive measures, such as wearing long sleeves, pants and repellents before going to the forest. Is there other way to avoid this transmission? Yes. Do not deforest." (CHOS, 9th grade).

Acknowledgments: All the communities involved, including the owners of Santa Rita, Almada, Bom Fin and Colônia de Una Farms. The Municipal and Bahia State Health Department, Evandro Chagas Institute, Project BioBrasil/Centre for Research and Conservation of the Royal Zoological Society of Antwerp (Belgium), ICMBio, Bicho-da mata NGO, Saint Louis Zoo WildCare Institute (USA), Institute for Conservation Medicine at the Saint Louis Zoo (USA), The Wild Animal Fund, from the American Association of Zoological Veterinarians (USA), CNPq (Brazil), the Center for Research and Conservation of the Royal Zoological Society of Antwerp (Belgium), Lion Tamarins of Brazil Fund, National Lottery of Belgium, Primate Action Fund, Zoological Society of London, Conservação Internacional, Fundação o Boticário de Proteção a Natureza, the Flemish Ministry of Science (Belgium).

Author's Bio

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UNDERWATER DISEASES… A SILENT THREAT: FUNGAL INFECTIONS IN OCTOCORALS

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Gorgonia ventalina from the Costa Rica Caribbean. Image from the Project.

Research on wildlife diseases is a challenge that goes from determining a significant sample size to choosing the sampling site and then confronting the particularities of field work and the studied species. The challenge intensifies when it is in the ocean where marine biodiversity is threatened by infectious diseases. Marine diseases associated to the increase in warming ocean conditions are silent and can reach a large scale before being noticed. Underwater diseases need to be stopped from spreading by identifying their causative microorganisms and the environmental conditions that trigger them. This requires significant scientific investigations together with government funding.

Conservation Medicine is an emerging discipline which combines disease investigation and the relationships of host, environment and pathogens, as well as the factors that cause changes in these interactions by using a multidisciplinary approach as a useful tool to redirect the research on marine diseases.

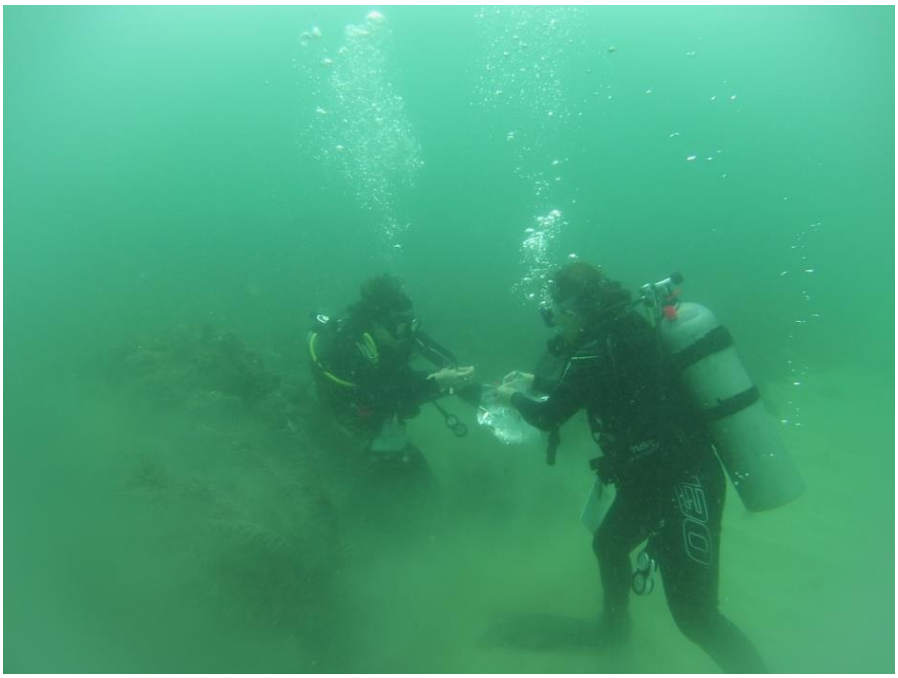
Octocorals are marine invertebrates important components of marine ecosystems. They create environmental complexity, leading to higher biodiversity, are producers of secondary metabolites and are attractive animals for tourism. As many other marine animals, octocorals are being threatened by global warming and other anthropogenic stressors, such as land-based pollution, over extraction, sedimentation and other human related activities (Burge et al., 2014) which have triggered emergence of pathogens.

Regarding pathogens, four out of five diseases and syndromes described in octocorals are related with fungal overgrowth: Black Band Disease, Aspergillosis, Fungal-Protozoan Syndrome and skeletal anomalies (Sutherland et al., 2004); the latter related with Labyrinthulomycetes overgrowth (Burge et al., 2012). All these pathologies have water temperatures increase as the common triggering factor. The most relevant example is aspergillosis, caused by *Aspergillus sydowii*, which produced several mortalities in the sea fan (*Gorgonia* spp.) during the last El Niño events at different sites in the Caribbean (Smith et al., 1996).

In Costa Rica, during the 1980´s an episode of high rate mortalities occurred in gorgonians (*Gorgonia flabellum*) but the cause was never elucidated (Guzmán & Cortés, 1984). Researchers hypothesized that an infectious agent could have

been involved after other factors such as temperature, salinity, sedimentation, pollution and waves were ruled out since other individuals were exposed to the same factors but only gorgonians were affected. Three decades later, disease investigation in Costa Rican octocorals remains unexplored.

In order to provide a baseline study on the etiology of octocoral lesions and fungal involvement in the Caribbean of Costa Rica during the 2015-2016 El Niño event, an interdisciplinary group was integrated including a veterinarian, a microbiologist, a marine biologist specialized in corals and a veterinary pathologist. The aims of this study were to answer questions such as if are fungi present in octocorals?, do the octocorals have lesions?, is there any biotic or abiotic factor related with the presence of the lesions and/or the fungi? and lastly, are fungi present in the lesions?



Field work. Dr. Andrea Urbina giving to Dr. Alejandra Calderón a tissue sample from a *Pseudopterorgorgia acerosa.* Notice the sea currents as an example of the field work particularities. Image from the project.

To accomplish these goals, dives at different sites of La Amistad Caribe Conservation Area, on the southern Caribbean coast of Costa Rica, were performed. The diving sites were selected by a local fisherman and personnel of a tourism agency after they saw pictures of the octocorals. Tissue samples from 55 healthy and diseased colonies together with temperature, pH, depth, salinity, geographical coordinates, and size of the octocorals were recorded. Description of lesions and identification of fungi were carried out based on reference guides (Work & Aeby, 2006; Raymundo et al., 2008; Samson et al., 2010; De Hoog et al., 2014). PCR using beta-tubulin primers followed by sequencing were used for *Aspergillus* identification.

This investigation demonstrated the presence of lesions in three out of ten colonies. Differences in the number and kind of fungal genera were found between healthy and diseased tissues suggesting changes in the mycobiota according to the health status. No relationship between octocoral dimensions and abiotic parameters, and the presence of lesions and / or isolated fungi were found. Fungal hyphae associated with tissue reaction were demonstrated by histopathology in some of the affected colonies. The isolation of hyaline and dematiaceous fungi from these lesions matching with their parasitic adaptation leaves the question if new fungal etiologies could be involved in octocorals lesions in Costa Rica. It is worth noticing that the highest number of diseased colonies and fungal genera isolated where from three sites near rivers that cross agricultural lands (Calderón-Hernández, 2017).

Multidisciplinary and longitudinal studies are necessary to elucidate the pathogenic or opportunistic role of that silent threat, the fungal infections, and the factors involved in tissue damage in order to provide knowledge leading to octocoral conservation.

Special acknowledgements to CONICIT and MICITT institutions that financed the master studies, to Dr. Esther Peters for her histopathology advices, and to the institutions, professionals, students and people from the Caribbean communities involved with this project.

Authors' Bio

Alejandra Calderón is a veterinarian and a Master student in Conservation Medicine. Andrea Urbina is a microbiologist, Master in Tropical Diseases and chief of the Mycology Laboratory. Juan Alberto Morales is a veterinary pathologist, who had special interest in wildlife and fish pathologies. Jorge Cortes is a marine biologist, coral´s specialist and the CIMAR Director.

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66TH WDA ANNUAL INTERNATIONAL CONFERENCE

Last July the 66th International Conference was held in San Cristobal de las Casas, Mexico. A total of 186 summaries were presented, 79 of which were Latin American studies. In the distribution by country, Mexico held the first place, with 44 abstracts, followed by Chile (15), Brazil (10), Costa Rica (4), Argentina (3), Trinidad and Tobago (2) and Colombia (1).

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As for the awards, we have the honor to inform you that the Wildlife Veterinary Section Travel Award for Oral Presentation went to Dr. Lilian Catenacci, from Brazil, while the Wildlife Veterinary Section Travel Award for Poster Presentation went to Sofia Bernal, from Costa Rica.
So we extend our congratulations, these girls represent well the Latin American community, well done!