Testing Tigers

TERENGGANU, MALAYSIA – The young male Malayan tiger stepped out onto the road, undeterred by the oppressive heat of the midday sun. The security of the forest shadows meant nothing to him now as he padded dully across the searing tarmac. The respiratory infection that had laid him low was now gone, and at least outwardly he appeared back to full health, yet his mind had submerged into the fog and his world was robbed of its allure, danger, and fire. The smells and sounds of people that once repelled him drained into the background and he blinked placidly at the vehicles and crowds that began to gather around him. Then everything went black.

Creating Partnerships to Assess Disease Threats to Tiger Conservation

by Martin Gilbert, Associate Professor of Practice, Population Medicine and Diagnostic Sciences

The tiger, soon to be named 'Awang Besul', was taken into care by the Terengganu Wildlife and National Parks Department (Perhilitan), then transferred to the National Wildlife Rescue Center in Sungkai, Perak. Initially he ate and drank on his own, but his neurological disease worsened. Despite the best efforts of the veterinarians caring for him, his condition deteriorated, and he died just four days later. Suspicion focused on canine distemper virus, and it was soon announced that Awang Basul was the first case of the infection recorded in a wild Malayan tiger.

Canine distemper virus (CDV) is something of a misnomer. Although long recognised as a serious and often lethal disease of unvaccinated dogs, it is also commonly found in wild carnivores, from the raccoons of urban America to the lions of the Serengeti, and even the seals of the Caspian Sea. But the case of Awang Besul was an alarming development. Fewer than 100 Malayan tigers remain in the forests of Peninsular Malaysia and the subspecies is now recognized as critically endangered. In better days, in the early twentieth century when tigers thrived throughout the verdant forests of Southeast Asia, outbreaks of disease were inconsequential, with any deaths quickly replaced by the abundant breeding population. But in today's world, with depleted tiger numbers scratching out a living in remaining pockets of snare-infested forest amid a sea of rubber and palm oil, every death counts and an outbreak of disease can drive the last nail into the coffin of population extinction.

The story of CDV in wild tigers didn't begin in the tropical swelter of Malaysia, but three thousand miles to the north in the frozen taiga forests of the Russian Far East. Concerns were first raised following the death of a young tigress in early 2004, but it wasn't until 2010 – when a series of cases were detected in widely scattered locations – that alarm bells really started to sound. At the time, I was working as a wildlife veterinarian for the Wildlife Conservation Society, and I made my first visit to Russia to investigate whether distemper might pose a threat to the Amur tigers (also known as Siberian tigers) that live there. My research there – which became the focus of my master's degree and then of my PhD – found that the virus did indeed pose a threat to the tigers, particularly the smaller and more isolated populations that had become the reality for most tigers worldwide by that time.

By the time I joined Cornell University in 2016, we had accumulated a fairly detailed understanding of the epidemiology of CDV in Russia and its impact on the tiger population there, but almost nothing was known about the threat it posed to tigers elsewhere in the species' range. Researching the health of an animal as rare and elusive as the tiger is a challenging proposition. How do you study a species that is observed so infrequently? Compounding this, the virus itself can be hard to find. Infections last just a few weeks, and either kill the tiger host or are vanquished by its immune system. The answer lies in the longevity of this immune response, with antibodies to CDV remaining detectable for years in those tigers that survive infection. Detection of antibodies in tiger blood is therefore the key to assessing the level of CDV exposure in a tiger population, and with antibodies now found in a third of Russian tigers, we have a benchmark against which to compare.

Although in theory these tiger antibodies are a prime target for surveillance, the practice of detection presents a considerable challenge. Commercial test kits designed for measuring CDV antibodies in dog blood have proven useless for screening tigers, as the dog-specific indicator reagent they use fails to bind reliably to tiger antibodies. The most practical alternative is called a serum neutralization test (SNT).

This does not detect the antibodies directly, but measures the ability of serum (due to the antibodies it may contain) to neutralize virus and prevent it from infecting cells. However, this is more technically demanding and largely unavailable in the countries that tigers inhabit. Prospects for shipping tiger samples for testing in international laboratories are hampered by export restrictions in some countries, and the reluctance of others to issue CITES permits (designed to regulate trade in endangered species) unfortunately and ironically curtails access to critical wildlife health diagnostics. This leaves us with only one option – if we cannot get the sample to the laboratory, then we must take the laboratory to the sample – and set up our own SNT protocols in tiger range countries.

With generous support from the Cornell Feline Health Center, we have now introduced SNT protocols to Chulalongkorn University in Thailand, Bogor Agricultural University in Indonesia, and the Agriculture and Forestry University in Nepal. Our training sessions have included veterinarians from each of these countries as well as colleagues from the tiger range states of Bhutan and India. Most crucially, we have been able to use these tests to screen archived samples from wild tigers, and have confirmed the presence of CDV exposure in tigers in Sumatra and in Nepal for the first time.

Simultaneously, we have also been working to strengthen our capacity to investigate wildlife mortalities, including those of tigers, in the countries we work in. Once again, we are focused on local solutions – an approach that is more cost effective and sustainable in the long term. In Nepal, the most significant bottleneck to post-mortem diagnosis is a lack of local capacity in wildlife pathology. Using local facilities, we were able to make ultra-thin sections of tissues for examination under the microscope, but Nepal lacks veterinary pathologists with the expertise needed to interpret the diagnostic changes they contain. To solve this, we are grateful to Grundium, a company in Finland that donated an Ocus 20 scanner – a precision instrument capable of digitizing our tissue sections, while withstanding the rigors of field life. These high-definition images can then be shared via a web-based platform donated by PathoZoom to specialist wildlife pathologists anywhere in the world, thus delivering vets in the field the key diagnoses they need in near real time. In this way, we have diagnosed cases of CDV in a tiger and a leopard in Nepal. But just as crucially, the images and the records of expert feedback represent a growing catalogue of case material for training future wildlife pathologists in tiger range countries like Nepal, bringing benefits for the conservation of tigers and other wildlife once it is in place.

Of course, diagnostic tools are just one piece of the disease surveillance process. A great deal of planning is required to collect valuable blood samples during those rare occasions when wild tigers are handled (for conflict management, rehabilitation or research). These samples must then be safely frozen, with contingency plans in place to control for failures in electricity supplies that can occur anywhere, not just in remote field stations or wildlife rehabilitation centers. Transfer to the laboratory brings its own challenges, with bureaucratic needs and logistical hurdles, and access to sufficient coolant to navigate the transport connections necessary to ensure a safe delivery. All of this requires good relationships and communication between the people involved at each stage of the process, and the support of the government agencies responsible for wildlife management. With all of this in mind, we were delighted to receive invites from the Ministry of Environment and Forestry (MoEF) in Indonesia to contribute to a workshop held in Bogor on Java during September 2022, which would begin planning for a national CDV surveillance program for Sumatran tigers.

With travel supported by the Cornell Southeast Asia Program and the charity Wildlife Vets International, I was able to fly out to join my colleague, veterinarian Dr. Jessica Bodgener, who had worked with me throughout our distemper research in South and Southeast Asia. Before reaching Indonesia, we took the opportunity to call into Kuala Lumpur, to give a lecture at the Veterinary Faculty at Universiti Putra Malaysia (UPM) and meet with a dynamic group of veterinarians and ecologists developing their own research on CDV in Malaysia's forests. We also met with the veterinarians at Perhilitan's National Wildlife Forensic Laboratory to discuss the practicalities of monitoring CDV in Malaysia's tigers. Our new UPM colleagues agreed to join the Bogor workshop, and we began planning to establish the SNT techniques in their laboratory to begin testing for antibodies in Malaysian samples.

Days later, after landing in Indonesia, we accompanied team members from meeting organizers Forum HarimauKita (FHK) on a flight to Sumatra, where we visited a tiger rehabilitation center and learned more about the local practicalities of sampling tigers in the field. Hosting wildlife professionals from across civil society, FHK acts as a technical hub for coordinating the conservation of Sumatran tigers. After a day's travel from Medan, we reached Barumun nestled in the low forested hills of South Tapanuli, replete with the haunting song of siamangs. Center manager Syukur Alfajar explained that the site was home to six tigers, all rescued from encounters with people. With the encroachment of human society, contact between tigers and people inevitably increases, leading to incidents of conflict and injury of both parties. The government's Natural Resources Conservation Agency (also known by the Indonesian acronym BKSDA) oversees the rescue of tigers in difficulty and coordinates their placement within a network of government and privately run rehabilitation facilities scattered throughout the country. As we toured the facility, the tigers remained hidden from view, secure in their extensive and thickly vegetated enclosures, with barriers limiting contact with the center's few workers. But as our visit drew to a close, and we turned to leave for our vehicle, a spleen-splitting roar ripped through the greenery, leaving no doubt whose realm we were leaving.

Left to Right:

Virologist Navapon Techakriengkrai (Chulalongkorn University) guides Silmi Mariya (Bogor Agricultural University) on the interpretation of the serum neutralization test. (Photo credit: M. Gilbert)

Martin Gilbert digitizes histopathology slides using the Grundium scanner in Nepal. (Photo credit: J. Bodgener)

Manager of the Barumun Centre, Syukur Alfajar uses a remote camera to monitor the Sumatran tigers being rehabilitated at the facility. (Photo credit: M. Gilbert)

Back in Bogor, the delegates were welcomed to the workshop by Drh. Indra Exploitasia, Director with the MoEF-Directorate of Biodiversity Conservation of Species and Genetics (KKH). Our new friend Syukur sat alongside representatives from each of the other rehabilitation centers, together with vets from BKSDA and Indonesian zoos, conservation agency representatives, as well as laboratory specialists. Dr. Bodgener and I presented sessions on CDV epidemiological theory and surveillance, providing context from our experiences elsewhere in the tiger's range. Other delegates spoke of the day-to-day realities of tiger rehabilitation and the capabilities of national laboratories. A series of animated group discussions then ensued, tackling the key individual components of a disease surveillance system. Finally, these coalesced in the closing sessions into an outline of recommendations for a national surveillance plan.

There are times when the issues facing wildlife conservation can feel overwhelming. With a conveyor belt of tragic stories scrolling through our daily news feeds it is easy to feel helpless. But events like the one in Bogor provide reason for optimism. Regardless of the challenge, there are people with the interests and skills that are needed to address any wildlife conservation problem. These people are the building blocks, and with sufficient vision, coordination, and cooperation we have all we need to formulate a cohesive and effective response. Together, the Bogor delegates had prepared a blueprint to begin addressing CDV in Sumatran tigers. We now know what to do, and we know how to do it – all that is needed is that last step of putting theory into practice. The ball is now in the Indonesian government's court; only they have the mandate to move things forward. But in doing so, they would make an important statement, as Indonesia would become the first country in the world to implement a national surveillance system to monitor the health of wild tigers.